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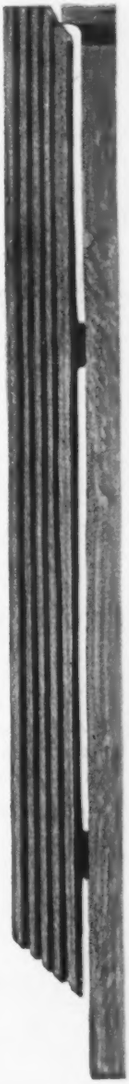

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Electrical World

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A NEW NAME AT THE MASTHEAD

WITH this issue of the Electrical World a rearrangement of its editorial staff becomes effective—happily one that does not involve the severance from it of any of those now responsible for its policy and management. William H. Onken, Jr., editor for eleven years, becomes senior editor; L. W. W. Morrow, managing editor since 1925, becomes editor, and Allen M. Perry, recently associate editor, becomes managing editor.

In naming Mr. Morrow editor the publishers repose full confidence in his ability to promote the standards and spirit of service that have characterized the Electrical World from the beginning. He has made his mark in electrical circles and is well qualified to guide its editorial destinies. With an electrical engineering education as a foundation, he built a superstructure of technical knowledge through ten years' teaching at Cornell, the University of Oklahoma and at Yale. In addition he has a broad experience in consulting engineering, in association work and in editorial executive duties, together with an intimate field knowledge of the electrical industry and its problems. He has had a rounded experience of unusual excellence.

Mr. Onken has served as the editor of the Electrical World with conspicuous ability and success. He has a background of knowledge and experience to which few in these days of ultra-specialization can lay claim. The position of senior editor will relieve him of executive responsibility and will enable him to devote his editorial talents and knowledge of industry with greater freedom to special industry problems and to other editorial duties in the McGraw-Hill Publishing Company.

Mr. Perry has grown up with the paper and is well known in the industry. In his fifteen years' service he has been field man, junior and senior engineering editor, Western editor and associate editor at the home office. He now turns to the important task of the managing editorship, and to him the maintenance of the high standards set for staff members and contributors alike may with every confidence be intrusted.

These appointments are made in the firm belief that they will enable the Electrical World and McGraw-Hill to enhance their service to engineering and industry, and the publisher believes these editorial changes will strengthen the magazine as a constructive factor in the electrical industry to which its loyal service has always been given.

James H. McGraw.

Herbert Hoover and the Electrical Industry

ELECTION over, the stock market has reflected by sharp advances in public utility stocks a sentiment prevailing among utility executives as well as in banking circles that Mr. Hoover's triumph in the national election augurs well for the electric public utility companies. It is a tribute to the industry to get such an indorsement, even though it be indirect; but the only assurance the utilities are justified in holding firmly is that any congressional legislation affecting them will be accepted or rejected by a President possessing toward utility problems a wise and an understanding heart. Any other interpretation of the election is unwarranted.

It is wrong for any industry to attempt to cast its burdens upon the shoulders of Herbert Hoover, because he will have enough other and more important burdens to bear. It ought to be likewise apparent that, as President, Mr. Hoover cannot inaugurate or prevent any legislation by Congress favorable or inimical to public utilities. He will have, of course, the power of veto, which may or may not be effective. As an avowed champion of the cause of private initiative and enterprise, however, Mr. Hoover's influence will be potent with the body politic. The utilities have a great opportunity to buttress the faith of the country in the efficacy and superiority of private enterprise compared with government ownership and to render unwarranted any further legislative excursions into socialistic fields. The all-important task for them to set for themselves is to be ready to render the service which at this moment the nation most needs. The country has been set right in its thinking about the functions of government, so that the industry may devote itself wholly and unreservedly to its primary duty. This performed, it will merit and receive popular as well as presidential support and approval.

* * * *

Daylight Ahead on Standardization

INDUSTRY has at last evolved a logical mechanism for making standards. Unanimous approval of the 37 member bodies of the American Engineering Standards Committee brought about the extinction of this committee and the birth of the American Standards Association. After many tribulations industry has reached a

workable plane in standardization and has adopted a common-sense procedure.

The new standards-making body has an executive staff, a counselor staff of industry executives and a procedure that should bring quick results. There is decision as to whether a standard is needed, as to how it should be formulated and as to its application by industry. Flexible methods are provided in making standards and all industry standards work is co-ordinated.

With an executive board of twelve industry executives to control policies and administration and with provisions for group conferences on proposed standards, tools are provided to start standards off on a basis of value and to produce them under authority far superior to that possible with a committee form of organization. Moreover, the scope of activities is enlarged to take in all industry groups and all kinds of standards, and under the flexible-procedure provisions the trade associations, professional societies and other organizations now making standards can be utilized fully and yet can retain initiative in making standards for their respective fields of activity.

It will take time and forbearance to work out details in the new organization, but the basic principles are so sound and logical that they can be applied with a minimum of experience. This great forward step in industry standardization is a credit to industry and to the men who were responsible for its formation. The American Standards Association deserves and will receive the whole-hearted support of all fair-minded men.

* * * *

This Mechanized World

MOST of us are so busy with our daily duties that we are rarely able to climb the mountain top and view our personal or group activities in their relationship to the world's progress. We are prone to leave that sort of thing to the seer, the statesman, the philosopher. Breadth of vision is the gift of the few; the ability to act courageously in the light of that vision is still more rare.

But, in peace as in war, progress toward an intelligently conceived ideal becomes possible only by co-ordinating the activities of many. An occasional glance around is good for us all. Those who have anything to do with applied electricity in the United States are aware of its growth. Is this an American phenomenon, affecting our own country solely, or are we participants in a world-wide movement that is profoundly modifying the progress of civilization? After all, to the man from Mars the United States is but one nation in many. We probably constitute less than 7 per cent of the world's population.

Foreign figures show that in this electrical growth we are not alone. In Great Britain the horsepower of industrial electric motors operated on purchased energy multiplied fourfold between 1912 and 1924. During the same period the rating of generators in public-supply plants increased at the rate of 8.6 per cent annually, compounded. Canada has doubled her monthly energy production since 1924. Berlin during the past four years increased its annual consumption successively by 15, 36, 8 and 27 per cent over that of the preceding year. In West Java, in the Dutch East Indies, though the actual output is only that of a moderate-sized American city, there was an increase of 25 per cent in 1927 over 1926. From the far corners of the earth the story is the same: Sources of power increasingly harnessed, distributed and applied through this most adaptable agent.

The engineer has given to humanity a tool whereby the output of human industry is being prodigiously multiplied all over the world. The result is a universal increase in man's material possessions. The wise use of these possessions and of increased leisure does not concern the engineer or the business man as such, but it concerns him profoundly as a member of the society of mankind.

* * * *

What Pennsylvania Electrification Means to Utilities

THE hundred-million-dollar program of the Pennsylvania Railroad for completing its electrification between New York City and Wilmington, Del., is significant in many ways. This railroad has had experience with 960 miles of electrical track and with both generated and purchased power. With this experience in mind it has determined to electrify 1,300 more miles of track and purchase the additional power needed.

This decision is suggestive of what other railroads can profitably do where they face terminal, tunnel, grade, suburban and dense-traffic problems that cannot be solved because of limitations on the laying of additional tracks. The fact that this single electrification will require about 15 per cent of one electric service company's output is indicative of the business that other utility companies may acquire where they are favorably situated. How much of their business should be tied up with one specific class of business is an economic problem they will have to determine for themselves. From the public viewpoint, it is the combined power service to diverse industries that provides the greatest opportunities for the best electric service and rates.

To minimize its financial outlay for electrification, the Pennsylvania Railroad has electrified gradually as economy dictated and has planned to purchase rather than generate its power supply. This procedure seems successfully to avoid the financial burden which some railroad executives consider always accompanies electrification.

Finally, the discussion of power supply has made the railroad and the power supply companies alike realize that they are both serving the public with money provided by the public—an important consideration in determining the principles which shall serve as the basis of contractual agreements. The rights of both parties must be protected by agreement, but sufficient latitude of operation must be allowed to insure that the general purpose of the contract shall not be defeated.

* * * *

The Part Radio Played in the Election

LOOKING back over the election, with its many angles of particular interest to electrical men, one feature of the campaign stands out in high relief—the part that radio played. For it cannot be questioned that this new service of nation-wide communication which electrical men have contributed within the last few years was a tremendous influence. It brought the voter into an intimate relationship with the presidential candidates that had never been known in a previous political campaign.

In 1924 radio broadcasting was employed to a limited extent, but there were comparatively few households that could benefit. Today the radio audience numbers probably somewhere between thirty and forty million people scattered over the entire nation. In every kind of home, in every class of community, in the most remote habitations of this broad land, men and women sat listening. They heard what was said and done at the nominating conventions. They compared the acceptance speeches of the opposing candidates. They weighed the appeals of the chief spokesmen of both parties. And whether it was in the city tenement, the factory worker's cottage or the farmhouse, speakers impressed their character upon the unseen audience and men and issues were discussed and opinions were crystallized into votes. Never before had a political campaign been conducted so in the presence of the voters. Never before had political discussion been based upon such intimate familiarity with the personalities and the policies concerned. Never before had men and women been placed upon such an even footing of political knowledge or displayed so much individuality in making up their own minds.

The very natural result was the largest registration and the largest vote ever recorded in America. Thirty-nine million citizens expressed their preference. They were enabled to do this and stimulated to do it because radio made them feel for the first time that they themselves were a vital part of the campaign. It was a splendid public service of which all electrical men should be proud.

* * * *

Trends in Municipal Plants

A SURVEY of the municipal electric light and power systems in the United States, of which the results are published in this issue, reveals the essential accord of their distribution with what might logically be expected. More than a sixth of them are in two prairie states, Kansas and Nebraska. Nearly half of them are to be found in eight Middle Western states. Two-thirds are in towns of 500 to 5,000 people. Only 60 per cent of them generate energy; the other 40 per cent operate exclusively on energy purchased, with rare exceptions, from private companies. Including several large cities that also have other electric service from private plants, the population in the areas served comprises 6 per cent of the nation.

This is what would be expected. An isolated small town is not necessarily a good prospect for a commercial enterprise, particularly if it is spread out over a considerable area, yet the citizens desired the service. At the time most of the systems were installed probably the only way these little communities could get the benefit of electric service was by action of the towns themselves. That such action was taken is evidence of community spirit and civic initiative. It is greatly to their credit that they recognized the advantages of electric service and obtained them despite economic handicaps.

Our present great transmission systems extending out from large cities are of recent growth. As they are extended to towns formerly dependent on local plants, one of two things usually happens: Either the town ceases to operate its generating station and begins buying energy, while continuing to sell at retail, or the whole system is sold to the private company. The former move is reflected in the large percentage of towns now served from outside; the latter in the change from municipal to private service, of which 200 or more cases are reported each year.

While the reasons that formerly led to the creation of municipal systems have lost much of their validity, and while the trend today is distinctly away from municipal operation, particularly away from municipal generating stations, their past contribution toward accelerating the widespread use of electric service may well be borne in mind.

* * * *

Power Sales Competition

POWER production practice in industrial plants has changed greatly in recent years. The consolidation of industry into large production units, the improvement in small power production devices and methods and the character of the growth of utility systems introduce new elements and new considerations. The utility power salesman finds industrial power business more difficult to get because the competition is stiffer, and yet widespread utility systems need industrial power business more acutely to stabilize operation and to get gross earnings. Power salesmen must have resourcefulness and intelligence if they are to bend conditions and events to the advantage of both the industries and the utility company.

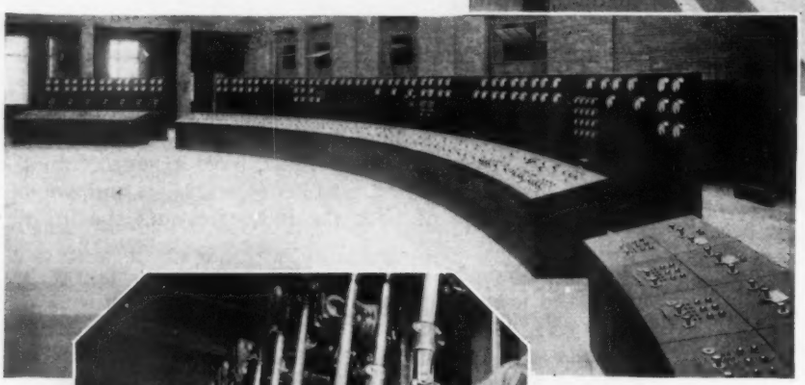
Formidable competition with purchased power is contained in many present developments and future possibilities. Efficiency improvements in small steam turbines and the adaptation of such units to manufacturing processes using steam no longer loom threateningly on the horizon—they have arrived! And their places in the distance are taken by even more horrendous shapes. Oil and gas engines are looking up in an interested and active manner. The theoretical thermal efficiency of these prime movers is splendid and their first cost is no longer prohibitive. The items of maintenance and depreciation on small units are losing the adjective "costly," which has been wedded to them so long, because of research on metals under high-temperature stresses and because of improvements in manufacture and design. These references are made to illustrate the point. They do not constitute a complete recital of manners and means by which competition has grown and will grow. business.

It will happen in some cases that the isolated plant, fairly analyzed, will show a saving over purchased power. But that saving will have to be very high in order to be an effective shield against the stout arrows in the power salesman's quiver. It is only a question of time when every private power plant will represent a loss because the difference between its costs and the cost of purchased power will be less than what the money in that plant will earn if it be invested in the owner's

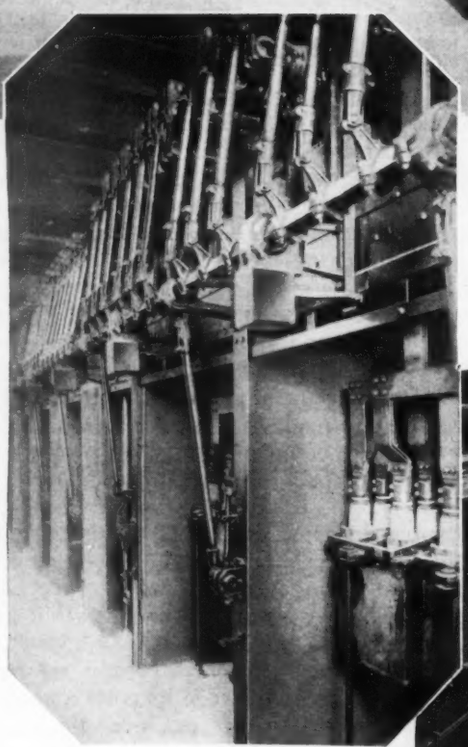
With a diversified network of utility lines serving this country and consequent diversity factor, load factor and low increment costs, the present and future trend is against the production of power by any unit in industry. But in some existing cases, especially where process steam is needed, there is opportunity for interconnections between utility and industrial plants to their mutual advantage. The logical economic analysis of present and future conditions must arm power salesmen, and each prospect for a power sale must be considered on its merits. Power sales are part of the new competition and need an industry-wide approach.

Electric Power in Sewage Disposal

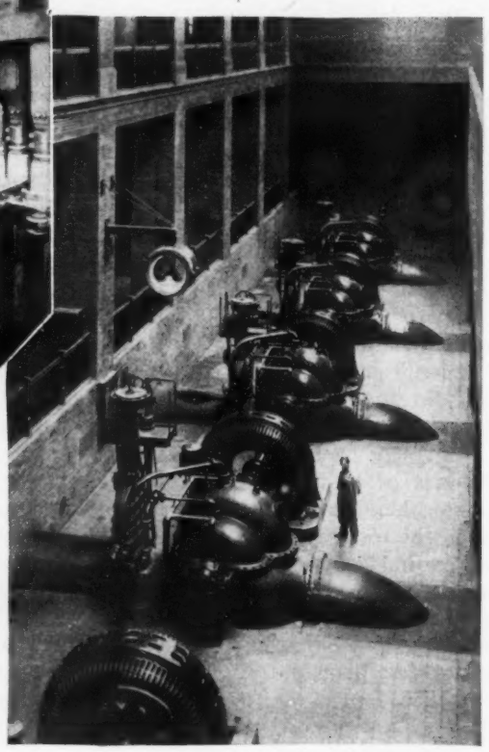
Blower room. The seven blowers furnish air at 8-lb. pressure for sludge activation. All motor drives are two-pole synchronous machines, 3,600 r.p.m., 6,600 volts, three phase. Three of the blowers are rated at 30,000 c.f.m. and are driven by 1,650-hp. motors; the four others deliver 40,000 c.f.m. and use 2,160-hp. motors



This is the main operating board. It comprises 44 panels and is 150 ft. long, one of the longest remote control boards in the world



Gang-operated disconnecting switches on the 440-volt bus. These disconnecting switches are extensively interlocked with related operating mechanisms



These five pumps lift the raw sewage into the plant. Two of them are driven by 1,000-hp. motors and three by 700-hp. units

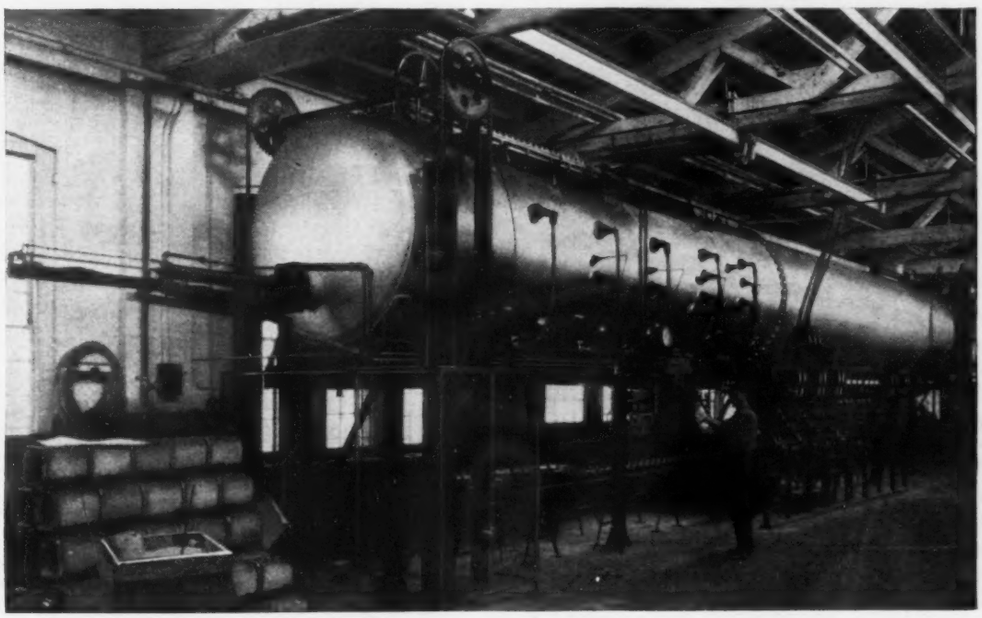
WHAT is said to be the largest activated sludge sewage treatment plant in the world, the North Side Sewage Treatment Works of the Sanitary District of Chicago, was publicly opened on Sept. 3 and is now in operation. It is designed to cover the requirements of a population of 800,000. Energy for the plant, which is wholly electrically operated, is supplied by the Public Service Company of Northern Illinois and by the Lockport power house of the Sanitary District electrical system. Service from the utility's lines is furnished at 33 kv. and is stepped down to 6,600 volts in two 15,000-kw. transformer banks, one of them a spare.

Electric Heat Treating*

Development of electric heating a valuable contribution to manufacturing industries in improving quality, reducing costs and increasing output

By A. N. Otis

Industrial Heating and Welding Department, General Electric Company



Pusher type continuous copper brazing furnace

THE advent of the electric furnace into the industrial field as an aggressive competitor of fuel-fired furnaces has exerted a decided influence on the design of all furnace equipments. For example, automatic temperature control was unknown until it was developed for use with electric furnaces and it is now considered a prime requisite of heat-treating furnaces of whatever type. Also, improved design in many ways has resulted from efforts to equal the performance of electric furnaces.

Furnace users generally, therefore, have received the benefits of improved equipment of every type. Modern electric furnaces are readily adaptable to special forms or designs of hearths and carriers to meet unusual requirements, and the fact that they can be located at the most advantageous point and fitted into the production scheme, like other machines, are important advantages in speeding production, reducing the cost of handling and increasing turn-over. They leave little to be desired in the way of operating characteristics or adaptability, and a discussion of the choice of furnaces will finally center about the cost of heat.

In any particular case the cost of heat can be accurately predicted under the contemplated conditions of operation and is a fairly simple matter. It remains, however, to balance this against the incidental economies and advantages procurable with the various types of furnaces under consideration, which is not so simple. The mistake should not be made of reaching a conclusion on the basis of cost of heat alone, or of any other single item, but all factors having a bearing on the problem should be given due consideration.

The manufacturer's object is to produce the highest quality product at the lowest cost, and heating operations should be viewed as a part of the whole process, rather than merely the economical use of fuel in a furnace. The use of electric furnaces, for example, may permit a complete rearrangement of manufacturing facilities, or in other ways make possible economies that are many times greater than the cost of heat.

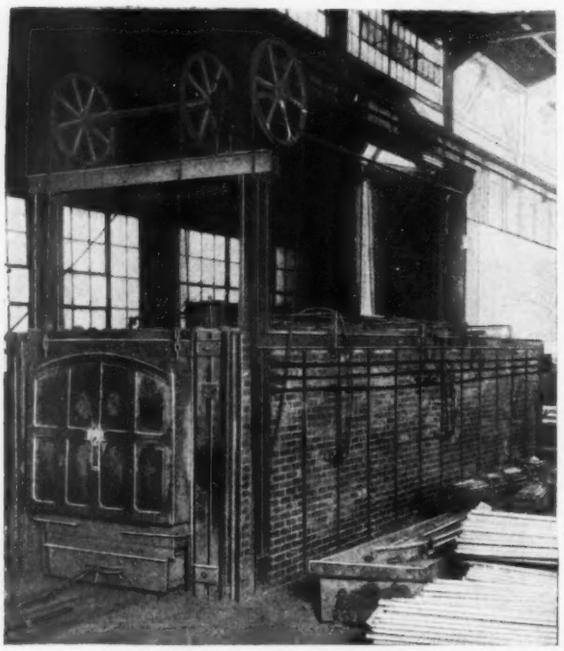
Heating Small Part of Total Production Cost

The cost of heat for most products is about 1 per cent of their value. The difference between fuel and electric heating, if there is a difference, will be so small in the average case as to have no appreciable effect on the production cost. This difference would easily be outweighed by any reduction in the number of rejects or retreats, greater uniformity, permitting higher speed of cutting operations, lower labor cost, facility in handling materials or other savings of rearrangement. These incidental factors are quite as important as the cost of heat, although they cannot be as readily obtained for comparison.

**Abstract of a paper presented before the American Society for Steel Treating at Philadelphia.*

The actual cost of heat in some applications is less with electricity than with fuels. This is particularly true where long heat cycles are necessary and losses are a large part of the total heat requirements, or where surplus material must be heated, such as annealing pots, that can be eliminated with electric furnaces.

Probably the largest electric furnace installation any-



Car type furnace for annealing alloy steel bar stock

where is at the Fordson plant of the Ford Motor Company. There are 145 furnaces at this plant used for a wide variety of work, such as heat treatment and forming of spring leaves, heat treatment of crankshafts, connecting rods, gears and other parts and heating stock for forging. There are 115 furnaces in one building, the spring and upset department: 76 for heat treating and forming springs, 28 for forging gear blanks and similar parts, six pusher furnaces for annealing, hardening and tempering, five for tools, dies and small parts.

The furnaces for hardening and tempering springs are equipped with slot conveyors and are operated at about 1,500 and 875 deg. F., respectively. When removed from the hardening furnace the leaves are clamped in a quenching fixture which forms and holds them to the desired shape.

Perhaps the most interesting are the furnaces for heating the ends of the long spring leaves, for forming the eyes which engage the shackle bolts. These furnaces are arranged in pairs, a conveyor running between them so that both ends are heated simultaneously. The temperature is 2,000 deg. F. Emerging from the furnace, they are placed in a forming machine which curls both ends at one operation. In each of the units leaves are heated and curled at the rate of eight per minute. The furnaces in this department are capable of handling 6,000 rear springs, 12,000 front springs and 2,500 springs for the truck in two eight-hour shifts.

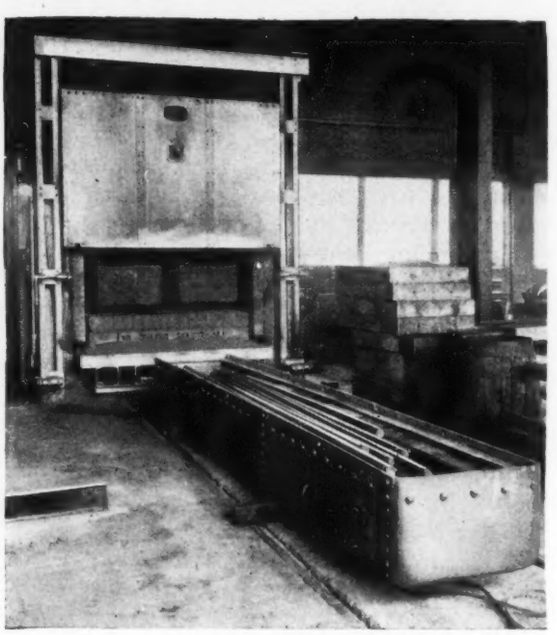
The forging furnaces are a recent development. The absence of smoke, excessive heat and gases is a very desirable feature which not only permits the furnaces to be located at the most advantageous points for the routing of the material but also provides the best possible conditions for the employees, so that they can work at maximum efficiency.

The furnaces operate at 2,350 deg. F. and are automatically controlled, which insures against burnt or overheated forgings, another valuable feature. About 700 lb. of forgings are produced per hour from each furnace and the yield is about 4 lb. per kilowatt-hour. Such furnaces may be used extensively in the future for light forging work and other operations which require these temperatures.

The continuous annealing furnaces are of the four-track, counterflow, pusher type, alternate rows moving in opposite directions.

There are nineteen furnaces of different types in the motors building. Three of these are continuous pusher furnaces, 24 ft. long, for hardening crankshafts. In order to save floor space the tempering furnaces are built on top of the hardening furnaces, with the entrance just above discharge opening of the hardening furnaces. They are of the chain-conveyor type, the finished work returning to the entrance end, where it is unloaded. Each unit has capacity to harden and temper 95 crankshafts per hour. Other furnaces in this building include: Three pusher furnaces for hardening connecting rods, three pusher furnaces for tempering connecting rods, three pusher furnaces, 42 feet. long, for tempering gears, two rotary furnaces, 14 ft. diameter, for hardening camshafts, two continuous furnaces for piston pins, push rods, etc.

In the rolling mill there are two continuous furnaces for heating bar steel for forming ring gears, 300 and 400 kw., respectively, operating at 2,000 deg. F.; six



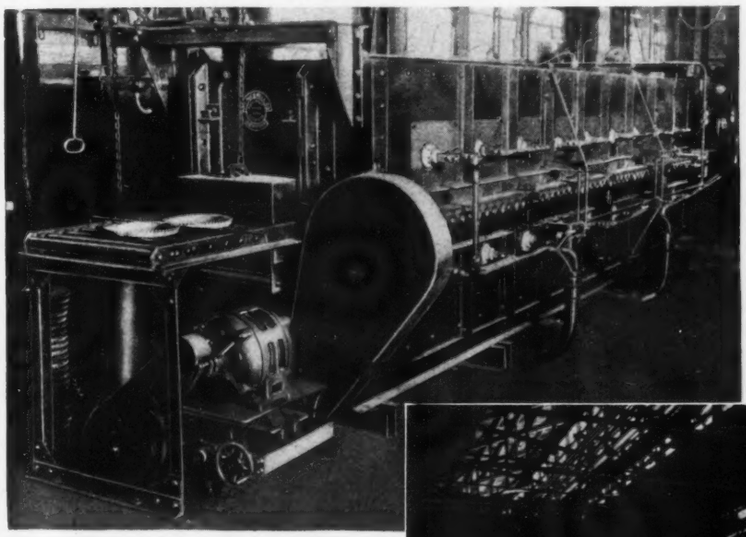
Car type furnace for annealing tool steel bars in boxes

forging furnaces, operating at 2,350 deg. F. and totaling 2,700 kw., also three continuous hardening furnaces of 300 kw. each.

Electric furnaces have come into quite general use for annealing tool steel bars and rods and a number of manufacturers of this material are now using electric furnaces

exclusively for annealing. Slow cooling is required and the material is placed in covered boxes in order to prevent decarburization during the long cycle, which is usually about 48 hours total. Five tons is the usual box load. These furnaces are of the car type, 2½ to 6 ft. wide and 16 to 20 ft. long, depending on whether designed for one box or two boxes per load. The connected capacity is 120 to 350 kw. A typical furnace with a loaded box in front to give more detail is shown here. Temperatures of 1,450 to 1,650 deg. F. are required for various kinds of stock.

The heating and holding time is 15 to 24 hours and the cooling time 20 to 30 hours. Three heats per week are usually obtained. The power consumed is 370 kw.-hr.



Roller hearth furnace for hardening ring gears

per net ton annealed under good conditions; that is, when in continuous operation and the furnaces charged while still warm, 800 to 900 deg. F.

A furnace designed for two boxes or a load of 10 tons will anneal 1,600 tons per year, and the total cost of annealing, including power, boxes, labor and capital charges, is approximately $10 per net ton. This may be segregated as follows, allowing 6 per cent interest on $10,000, the approximate cost of equipment, and 10 per cent depreciation:

Power—400 kw.-hr. at 1½ cents	$6.00
Boxes	0.65
Labor, use of crane and overhead	2.20
Interest on investment and depreciation at 16 per cent	1.00
Total	$9.85

The advantage of electric furnaces for this purpose lies in the uniformity of the annealed product and the fact that no labor for attendance is required for the heating operation.

Reanneals to meet the requirements of careful inspection will run from zero to 1 per cent. To pass the same inspection material from fuel-fired furnaces is said to require a considerably higher percentage of reanneals. At least sixteen furnaces of this type are in use at eight different manufacturing plants, and it is estimated that more than 50 per cent of the tool steel produced today is annealed in electric furnaces.

The elevator type furnace is particularly well adapted for annealing steel products in large quantities and is used for such materials as sheets and punchings for electrical machines, disk wheels for automobiles, gear blanks and castings.

One of the advantages attending the use of this furnace is the elimination of the boxes or containers formerly used with the fuel-fired furnace, saving the cost of boxes, which is a large item, as well as the fuel and time required to heat them. Much of the space required to store them while cooling and some of the labor required to handle them and pack the material are also saved.

The boxes often weigh as much as or more than the sheet steel itself, therefore twice the weight of steel must be heated, and the maintenance cost of the boxes is very high. It has been found that due to these factors the cost of annealing with electricity is considerably less than the cost with oil. Usually slow cooling is not essential and the loaded car is removed from the furnace when soaking has been completed. A hood or cover is lowered over the charge to protect it from the air and another charge is put into the furnace while it is still hot. This method of operation gives a large output per furnace and per unit of floor space, two or more charges per day being the usual schedule, and its advantages over the box method will be readily appreciated. The power consumed is about 200 kw.-hr per ton, depending on the size of furnace and heating cycle.

Group of electric furnaces for forging

A careful record was kept in 1924 on an electric furnace and a car type oil-fired furnace to determine the relative cost and quality of anneal as a basis upon which to reach a decision regarding new facilities about to

be installed. Both furnaces were practically new and of the same capacity, 3½ tons to the load. The electric furnace used a steel plate, upon which the sheets were loaded, and the oil furnace used one long pot to contain the sheets.

The plates cost $18 each and are good for 30 anneals, the pots cost $400 each and are good for 50 anneals. With 3½-ton loads this makes the cost of plates 0.86 cent per 100 lb. and the cost of boxes 11.4 cents per 100 lb.

No difference in quality was apparent from examination and none was found by magnetic tests. No difference in labor cost was claimed in this comparison, although some saving was expected in the contemplated installation.

The cost per 100 lb. annealed was found to be:

	Electric Furnace	Oil Furnace
Fuel	10.8 kw.-hr. = 13.5 cents	2.89 gal. = 16.5 cents
Bases or pots	0.86	11.4
	14.36	27.9

The progress in design of furnaces for heat treating has been supplemented by furnaces for other uses. Electric forging furnaces have already been mentioned. The method of heating for forging has an important effect on the quality of the finished parts and it is perhaps the least carefully done of any preceding or subsequent operation. The opportunities for improvement in these operations are well worth the attention of able engineers, and will probably receive it.

It is well known that the efficiency of electric furnaces at high temperatures is relatively much better than for combustion furnaces, this being characteristic of the types. The physical hardship of working near forging furnaces is well known, and this hardship is due largely to heat that cannot be used effectively.

In the average furnace 9 to 10 gal. of oil is used per 100 lb. of stock forged. This will cost, say, 55 cents. Electric furnaces will use about 25 kw.-hr. per 100 lb., which at 1¼ cents per kilowatt-hour will cost 31 cents. It is quite obvious that the cost of heat will be less with electric furnaces in the average case, and the advantages of greater comfort and higher efficiency of workmen, choice of location, saving in burnt stock, etc., are secured in addition.

Electric furnaces with atmospheres of protecting gas have recently been developed for copper-brazing steel parts together, making possible the assembly of complicated structures from simple parts by a strong alloy weld.

Atmospheres containing a substantial proportion of reducing gas, such as hydrogen, are essential, as its reducing action on oxides at high temperatures thoroughly cleans all surfaces, thereby performing the functions of a flux, as well as excluding air from the heating chamber.

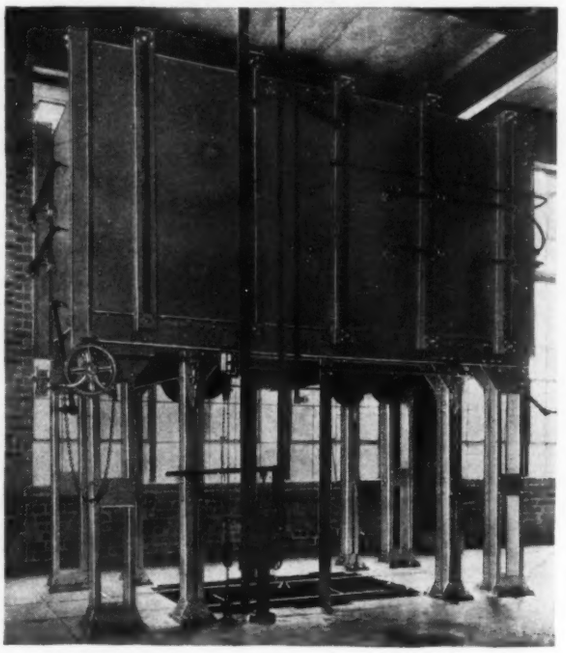
Copper wire or chips are placed adjacent to the joints to be brazed and the assembly heated to a temperature somewhat above the melting point of copper. The capillary attraction of the fluid copper causes it to spread over the surfaces and to be drawn into the minutest joints between the parts.

Furthermore, the limited but definite solubility of iron in copper at these temperatures causes an alloyed union or weld between the parts which is exceedingly strong and intimate. Relatively large surfaces can be effectively joined by this method, and in ordinary practice dozens of joints are made in complicated assemblies at one operation. The work must be cooled as well as heated in the atmosphere of protective gas in order to prevent scaling and this involves special types of furnaces if production requirements are to be met.

An intermittent type of furnace, adapted for large and small parts of various sizes and shapes, has been developed, and also continuous furnaces, adapted to a large output of a standardized product. One of these continuous furnaces is shown on page 979.

The charging and discharging doors are on the underside of the shell and at opposite ends. The work is loaded on suitable trays which are pushed through on a roller track by a hydraulic cylinder. All controls are interlocked so that the operations must be carried out in the proper sequence.

Only a part of the furnace is equipped with heating units, as may be noted by the terminals at the sides.



Elevator type furnaces

the remainder being provided with a water jacket, so that the work is cooled well below oxidizing temperature before removal.

The technique of this method has also been fully developed during the past several years and it is now employed extensively in important manufacturing operations by one company. It should be noted that electric furnaces have a unique advantage for processes of this kind, due to ability to control the atmosphere in them. Combustion furnaces are quite impracticable for this purpose. Furnaces of this type are also in use for bright annealing of certain non-ferrous metals to which they are adapted.

Continuous furnaces have been suggested for bright annealing of sheets in sheet and tin plate mills. The possibilities of savings in the cost of boxes, pickling, labor of separating sheets which become stuck together, torn sheets, etc., are very attractive. The process outlined is one of the outstanding furnace developments of recent years and the future may see many interesting applications of it.

It is quite apparent that the day of scientific industrial furnace engineering has arrived, and that in the

future furnaces will be selected more and more for their application value, which visualizes them in their correct relation to other agencies of production. Preconceived ideas regarding the practicability of one kind of furnace or fuel to the exclusion of others must give way to more careful analysis and appraisal.

There is no doubt that the development of electric heating has been a valuable contribution to the manufacturing industries, as an aid to improving quality, reducing costs, in providing better working conditions and enabling output per man to be increased.

General Lighting Plus

A new era in lighting the work-world. Adequate general lighting is essential, but supplementary local lighting must not be overlooked

By M. Luckiesh
Director Lighting Research Laboratory, National Lamp Works, Cleveland

LIGHTING interests have become generally cognizant of the fact that intensity of illumination greatly influences the ability to see. As a consequence, the level of general illumination is steadily being increased. The tardiness in recognizing the importance of intensity of illumination is not accountable for excepting by a general absence of a consciousness of lighting and even of seeing. However, there are other very important factors which have been generally ignored in lighting.

Any one who keeps his consciousness open to his own maneuvers in regard to lighting and seeing will convince himself that direction, distribution and quality of light and many other factors also greatly influence his ability to see. In looking at a small object or detail, one may turn it this way and that to obtain the proper shadow or high-light. He may go to a window to obtain more light, a better quality of light, or a certain direction or distribution of light. He may hold the object against a certain background in order to obtain a suitable contrast. These and many other acts are unconsciously performed to relate lighting to vision so as to obtain favorable seeing conditions.

The present age of relatively inexpensive and completely controllable artificial light inherited little knowledge of lighting for seeing, but researches are establishing the foundations of a new science of seeing. From these it is becoming clear that lighting—the external partner of the visual sense—can be a very much more important aid to vision than merely light or general illumination. Lighting for best seeing throughout the work-world generally cannot be achieved without localized lighting—properly controlled in quality, quantity and distribution—combined with general lighting.

When modern lighting began a score of years ago poor localized lighting was in vogue, the natural result of centuries of feeble sources of artificial light. This was swept out by general lighting—not the best solution, but an expedient one. With general lighting well under way toward higher levels of illumination and with much knowledge of lighting for seeing now available, the time has arrived to follow up with the addition of localized lighting of proper design. The illuminating engineer who did good work in the development of the foot-candle era of the past two decades has an opportunity to evolve into a seeing specialist by developing lighting for best seeing. Very extensively throughout the work-world this means the addition of properly designed localized lighting to general lighting.

We cannot have good lighting in most of the work-world without general lighting. We cannot have the best lighting for best seeing in most of the work-world without adding the refinement of localized lighting carefully designed and properly controlled in quality, quantity and distribution. Then general lighting will serve general purposes, movements of workers and materials, and localized lighting will serve specific purposes, serious vision and directly productive work.

The data and arguments which have been accumulated during a dozen years of study and research have been presented elsewhere.* For the sake of brevity some of the advantages of adding localized lighting to general lighting throughout the work-world are presented herewith without the supporting data.

High levels of illumination may be obtained which are otherwise economically impracticable, thereby obtaining more of the advantage of increased production, greater accuracy, increased speed of vision and compensation for low reflection factors of materials and low brightness contrasts of details. Installations of localized lighting up to several hundreds of foot-candles are now being made in addition to good general lighting.

Many Factors Must Be Considered

Light of special quality may be used where desired, such as white light or light of any color or quality which would aid vision better than ordinary light. A great refinement in lighting for seeing may be achieved by directing light so that shadows in critical details may be eliminated where undesirable or created to enhance their visibility; specular reflection may be eliminated where annoying or may be utilized to enhance visibility; any surface may be illuminated to any degree; backgrounds can be better employed to enhance visibility of work; the annoyance of shadows of machinery involved in the individual task can be eliminated.

Diverse work-places cannot be illuminated best at all points in any other way. The worker should be able to concentrate his attention better. Workers with subnormal vision may be supplied with more light than others to compensate to some degree for their deficiency. It makes it possible to supply more light when or where reflection factors of the work are low. There would be no reason for the worker to move himself or his work to an unusual position to increase visibility. It provides an easy way to demonstrate the advantages of really high intensities of illumination. It provides flexibility in lighting for seeing not otherwise obtainable. It decreases the glare from general-lighting equipment and from specular reflection of surfaces outside the work area. It should increase the safety of the worker. It tends to emphasize the importance of lighting. The localized lighting for any worker need not be in use when the worker is not in his place. A burned-out lamp would be replaced immediately and a rugged fixed system of localized lighting could be easily maintained at its original standard.

The foregoing is only a brief glimpse of this subject and the possibilities it presents. However, knowledge, incentive and results are already sufficient to inaugurate a new era of general lighting plus throughout the work-world. Employers, workers, lighting interests—and civilization in general—will profit thereby.

*"*General Lighting Plus*," M. Luckiesh; presented at I.E.S. convention, September, 1928.*

Circuit Breakers Eliminated on Rural Circuits

By C. S. Fiske

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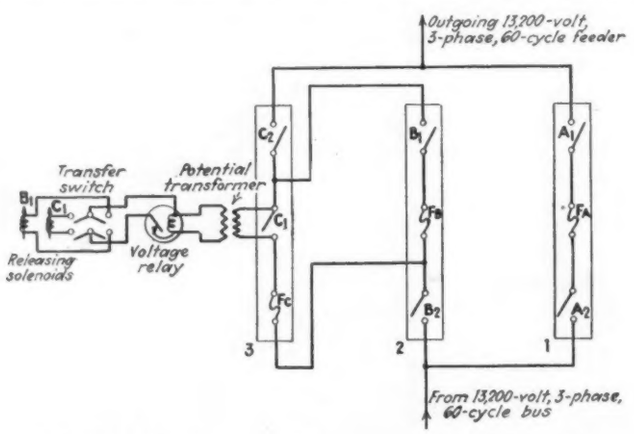
AN AUTOMATIC re-fusing device has been developed by the Consolidated Gas, Electric Light & Power Company for the purpose of isolating one or more phases of the supply circuits from its Gunpowder substation to several small rural substations. Fuses are considerably cheaper than single-pole, single-throw oil circuit breakers with motor-operated reclosing equipment and have been found to be entirely satisfactory in rupturing short-circuit currents.

Each phase of a 13,000-volt circuit is provided with three fuses, which allow two reclosures after the first fuse blows. The accompanying figure shows the equipment required for each phase of the 13,000-volt circuit. These fuses are shown at F_a, F_b and F_c. Disconnecting switches are provided for isolating the fuses and also to close in the second and third fuses when necessary. A description of the disconnecting switches follows: A_1, normally closed, stick operated; A_2, normally closed, stick operated; B_1, normally open, hand operated, remote controlled, closed automatically by spring; B_2, normally closed, stick operated; C_1, normally open, hand operated, remote controlled, closed automatically by spring; C_2, normally closed, stick operated.

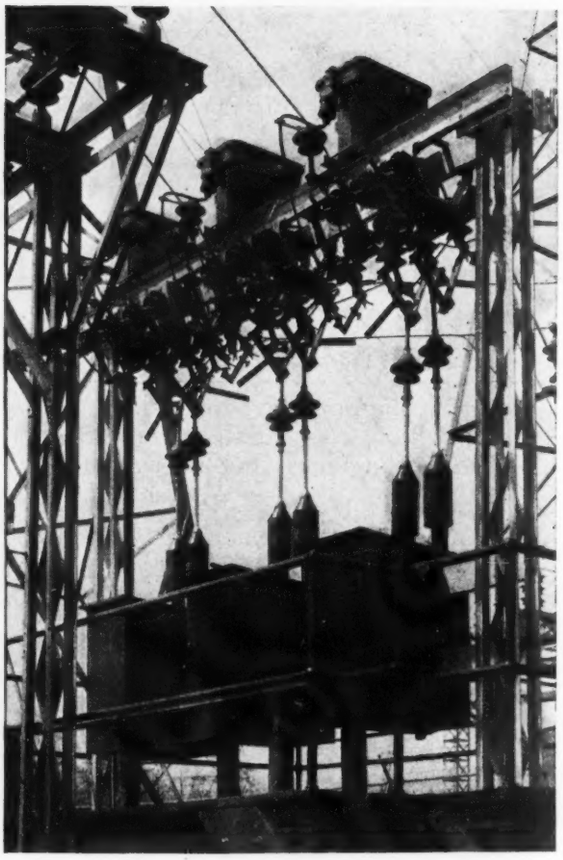
Switches B_1 and C_1 are connected by means of 1-in. pipe to a Westinghouse oil circuit breaker cover plate. This plate was remodeled so that each disconnect switch can be tripped or closed separately or in unison. Springs are attached to the operating rod, tending to close the disconnect switches. Switches are held open by dogs and latches which are released by potential trip coils on cover plate.

In the operation of this device the normal circuit is from the 13,200-volt bus through A_2, through



Double re-fusing on all three phases is provided

F_a, through A_1, to the outgoing feeder. Note that B_1 and C_1, being normally open, cause only fuse F_a to be in the circuit and that the primary side of the potential transformer is short circuited by fuse F_a. If this phase of the feeder becomes short circuited or grounded fuse F_a will blow and the circuit from the bus to the feeder will then be completed through the potential transformer connected across C_1 of combination 3. This energizes



Automatic re-fusing device applied to 13,200-volt rural feeder

the transformer, which applies potential to the voltage relay. Timing is provided on the relay to allow momentary trouble to be cleared before closing the second fuse. When the relay makes contact potential is applied to the transfer switch, which carries it to the trip coil connected to the mechanism of switch B_1. The holding latch on switch B_1 is then released and the spring closes the disconnect switch, putting fuse F_b in the circuit, which again removes potential from the primary of the potential transformer. When B_1 closes, the transfer switch is thrown so that the control circuit is transferred from the trip coil on B_1 to the trip coil on C_1.

If the trouble is momentary and has been cleared by the first opening, then the circuit will stay closed through fuse F_b. Fuse F_a may then be replaced, without interruption to service, by opening disconnect switches A_1 and A_2 and inserting a new fuse. A_1 and A_2 may then be closed and B_1 opened by means of the cover plate handle, thus restoring the circuit to normal conditions.

If the trouble has not been cleared fuse F_b will blow, once more energizing the potential transformer and causing potential to be applied to the trip coil of switch C_1. The spring on C_1 will then close this switch. This will insert fuse F_c in the circuit. If the trouble has been cleared by the blowing of the first two fuses then the circuit will remain completed through combination 3 until such time as fuses F_a and F_b can be replaced. If fuse F_c blows, however, it is indicative of permanent trouble and this phase of the line will remain open until the trouble can be repaired. The other two phases of the circuit will remain energized and thus partial service may be maintained.

The automatic re-fusing device has already been called upon to operate on numerous occasions and in every instance has proved entirely satisfactory. It has since been installed at three other locations in the rural districts and by its use many outages have been prevented in towns and rural settlements.

Use of Electrical Energy in Britain Reviewed by Edgcumbe

AT THE recent opening of the Institution of Electrical Engineers in London for the 1928-29 session the president, Lieut.-Col. K. Edgcumbe, dealt in his inaugural address with the position of the electrical industry. He said that in Britain power, apart from traction, accounted for about 71 per cent of the electrical output and lighting, together with other domestic uses, for only about 10 per cent. Statistics indicate that the amount used for domestic purposes is increasing more rapidly than that used for power, so that the lighting load (domestic, commercial and industrial), together with the domestic power load, would seem to offer the greatest possibilities for expansion.

The domestic field in Britain is still largely undeveloped. According to the Electrical Development Association, the number of electrically equipped houses constitutes about 20 per cent of the total number, compared with a reputed 60 per cent in the United States and 45 per cent in Germany. Although the number is at present increasing by about 25 per cent each year, there is still room for expansion. If every year the number of houses built and the number of additional houses connected continues as during the last year or two, the number of electrically equipped houses will, in ten years' time, represent from 55 to 60 per cent of the total.

Municipal Systems in United States

MUNICIPAL systems in the United States are confined in the main to the smaller cities and towns; they are most numerous in the great agricultural states of the Mississippi Valley; they are relatively rare in very small hamlets and villages; those that operate their own generating plants are more often to be found in the larger communities, while the practice of purchasing all the energy prevails increasingly as the size decreases from the 5,000 population group downward. These are some of the salient observations that follow from an analysis of the 1,524 municipal systems listed in the McGraw-Hill Central Station Directory for 1928. The only municipally operated systems not included are those restricted to street or other public lighting, and so not contributing significantly to the sale of energy at retail in their respective localities.

The summary by population groups indicates that 94 per cent of the systems are in towns of less than 10,000 population. The summary by states shows that Nebraska leads with 157, followed by Kansas with 117, Ohio with 89 and Minnesota with 87. Then come Iowa, 82; Wisconsin, 77, and Indiana, 72. The detailed tabulation by states and population groups will be found on the two following pages.

SUMMARY BY POPULATION GROUPS

Population Group	Number of Systems Total	Purch.*	Population Group	Number of Systems Total	Purch.*
Over 25,000	24	3	501 to 1,000	306	158
10,000 to 25,000	71	20	251 to 500	181	118
5,000 to 10,000	126	37	Under 250	45	33
2,501 to 5,000	260	73			
1,001 to 2,500	511	166		1,524	608

*Number of systems purchasing all their energy.

The population served, 7,361,293, constitutes about 6 per cent of the national total. Nearly half of this is in the 24 largest cities—those exceeding 25,000 population. A number of these cities also have private service. In some instances the latter constitutes an important part of the entire local supply, as for example in Cleveland,

Summary of Municipal Light and Power Systems

Showing Number of Systems Purchasing All Their Energy and of Systems Generating All or Part, with Aggregate Population Served by Each Group.

State	Number of Systems Total	Purchasing Exclusively	Generating and Purchasing	Population Served Total	Purchasing Exclusively	Generating and Purchasing
Alabama	18	10	8	53,378	21,486	31,892
Arizona	6	3	3	9,759	6,934	2,825
Arkansas	9	0	9	31,994	0	31,994
California	25	18	7	884,228	138,371	745,857
Colorado	29	8	21	65,550	3,541	62,009
Connecticut	5	3	2	62 164	26,728	35,436
Delaware	6	2	4	16,116	6,037	10,079
Florida	27	4	23	198,846	11,005	187,841
Georgia	61	26	35	193,968	107,260	86,708
Idaho	13	11	2	40,401	38,230	2,171
Illinois	42	8	34	189,569	43,736	145,833
Indiana	72	41	31	368,580	55,572	313,008
Iowa	82	31	51	149,128	23,988	125,140
Kansas	117	39	78	323,204	24,809	298,395
Kentucky	8	1	7	49,386	1,395	47,991
Louisiana	30	3	27	111,905	5,060	106,845
Maine	5	1	4	12,411	4,594	7,817
Maryland	6	0	6	40,245	0	40,245
Massachusetts	41	29	12	348,053	160,832	187,221
Michigan	52	11	41	256,105	47,674	208,431
Minnesota	87	43	44	226,905	72,184	154,721
Mississippi	23	0	23	54,286	0	54,286
Missouri	47	5	42	154,471	6,203	148,268
Montana	1	0	1	344	0	344
Nebraska	157	74	83	249,496	44,628	204,868
Nevada	3	2	1	2,626	2,081	545
New Hampshire	3	1	2	4,322	869	3,453
New Jersey	11	8	3	31,398	17,674	13,724
New Mexico	1	0	1	2,157	0	2,157
New York	43	23	20	193,814	76,964	116,850
North Carolina	32	21	11	121,796	64,184	57,612
North Dakota	16	2	14	19,238	5,361	13,877
Ohio	89	46	43	1,518,521	100,249	1,418,272
Oklahoma	60	15	45	127,089	18,245	108,844
Oregon	7	1	6	24,425	852	23,573
Pennsylvania	31	15	16	142,942	49,161	93,781
Rhode Island	1	1	0	3,680	3,680	0
South Carolina	29	20	9	90,600	64,809	25,791
South Dakota	35	10	25	45,698	4,954	40,744
Tennessee	15	2	13	46,116	7,339	38,777
Texas	33	1	32	140,580	821	139,759
Utah	18	5	13	44,475	4,666	39,809
Vermont	15	6	9	40,443	6,376	34,067
Virginia	11	1	10	53,465	4,159	49,306
Washington	12	7	5	437,719	14,828	422,891
West Virginia	4	0	4	6,495	0	6,495
Wisconsin	77	47	30	166,669	85,343	81,326
Wyoming	9	3	6	6,533	2,567	3,966
United States	1,524	608		7,361,293	1,385,449	5,975,844

Municipal Light and Power Systems in the United States by Population Groups

Segregated as to Systems Purchasing All Their Energy and Systems Generating All or Part of Their Energy

State	Population More Than 25,000						Population 10,001 to 25,000						Population 5,001 to 10,000						Population 2,501 to 5,000					
	Number of Systems			Population Served			Number of Systems			Population Served			Number of Systems			Population Served			Number of Systems			Population Served		
	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part
Alabama	0	0	0	0	0	0	1	0	1	14,466	0	14,466	1	0	1	5,696	0	5,696	4	2	2	13,610	7,605	6,005
Arizona	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	5,773	5,773	0
Arkansas	0	0	0	0	0	0	1	0	1	10,199	0	10,199	0	0	0	0	0	0	3	0	3	12,731	0	12,731
California	4	2	2	792,917	59,876	733,041	2	2	0	42,969	42,969	0	3	2	1	16,646	10,746	5,900	4	3	1	13,929	10,725	3,204
Colorado	1	0	1	30,105	0	30,105	0	0	0	0	0	0	2	0	2	10,913	0	10,913	2	0	2	6,330	0	6,330
Connecticut	0	0	0	0	0	0	4	2	2	58,968	23,532	35,436	0	0	0	0	0	0	1	1	0	3,196	3,196	0
Delaware	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	10,599	3,854	6,745
Florida	1	0	1	95,450	0	95,450	2	0	2	39,306	0	39,306	2	0	2	15,187	0	15,187	9	3	6	33,009	10,679	22,330
Georgia	0	0	0	0	0	0	2	2	0	36,974	36,974	0	9	5	4	61,062	33,770	27,292	13	4	9	43,646	14,704	28,942
Idaho	0	0	0	0	0	0	1	1	0	23,042	23,042	0	1	1	0	5,408	5,408	0	1	1	0	3,154	3,154	0
Illinois	1	0	1	63,923	0	63,923	2	2	0	37,472	37,472	0	4	0	4	23,299	0	23,299	10	1	9	35,394	2,803	32,591
Indiana	3	0	3	164,249	0	164,249	5	0	5	76,055	0	76,055	7	2	5	46,091	14,909	31,182	11	3	8	40,957	10,843	30,114
Iowa	0	0	0	0	0	0	1	0	1	16,068	0	16,068	4	0	4	26,781	0	26,781	12	0	12	40,650	0	40,650
Kansas	1	0	1	116,053	0	116,053	2	0	2	27,712	0	27,712	5	0	5	38,546	0	38,546	13	1	12	45,481	2,606	42,875
Kentucky	0	0	0	0	0	0	2	0	2	34,601	0	34,601	0	0	0	0	0	0	3	0	3	10,343	0	10,343
Louisiana	0	0	0	0	0	0	2	0	2	34,998	0	34,998	4	0	4	25,398	0	25,398	9	0	9	31,670	0	31,670
Maine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	11,103	4,594	6,509
Maryland	1	0	1	31,357	0	31,357	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3,442	0	3,442
Massachusetts	3	1	2	142,029	41,882	100,147	5	4	1	80,772	60,902	19,870	11	3	8	84,690	21,026	63,664	4	3	1	14,769	11,229	3,540
Michigan	1	0	1	73,200	0	73,200	5	1	4	74,345	13,103	61,242	7	2	5	44,584	13,414	31,170	7	3	4	28,167	13,638	14,529
Minnesota	0	0	0	0	0	0	3	0	3	46,055	0	46,055	6	2	4	43,163	17,554	25,609	21	6	15	70,045	20,260	49,785
Mississippi	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	15,345	0	15,345	5	0	5	16,566	0	16,566
Missouri	0	0	0	0	0	0	4	0	4	53,643	0	53,643	4	0	4	26,015	0	26,015	9	1	8	28,491	2,685	25,806
Montana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nebraska	1	0	1	60,941	0	60,941	2	0	2	28,556	0	28,556	3	0	3	25,052	0	25,052	8	2	6	27,689	6,704	20,985
Nevada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Hampshire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Jersey	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	18,918	5,523	13,395	3	3	0	9,619	9,619	0
New Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New York	1	0	1	43,414	0	43,414	5	2	3	67,191	26,053	41,138	4	3	1	29,059	23,733	5,326	5	3	2	18,913	11,069	7,844
North Carolina	0	0	0	0	0	0	4	1	3	48,436	10,331	38,105	4	3	1	25,483	19,169	6,314	9	7	2	30,618	24,692	5,926
North Dakota	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	11,376	4,178	7,198
Ohio	3	0	3	1,263,849	0	1,263,849	3	2	1	52,535	36,986	15,549	12	2	10	79,295	11,137	68,158	15	4	11	56,105	13,858	42,247
Oklahoma	0	0	0	0	0	0	0	0	0	0	0	0	4	1	3	27,053	6,414	20,639	14	0	14	49,207	0	49,207
Oregon	0	0	0	0	0	0	1	0	1	11,421	0	11,421	0	0	0	0	0	0	2	0	2	7,050	0	7,050
Pennsylvania	0	0	0	0	0	0	3	1	2	40,742	15,580	25,162	7	2	5	51,540	12,505	39,035	9	2	7	32,783	7,234	25,549
Rhode Island	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	3,680	3,680	0
South Carolina	0	0	0	0	0	0	0	0	0	0	0	0	5	4	1	38,164	32,023	6,141	7	4	3	27,222	16,905	10,317
South Dakota	0	0	0	0	0	0	1	0	1	10,319	0	10,319	0	0	0	0	0	0	4	0	4	15,969	0	15,969
Tennessee	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	12,319	0	12,319	6	2	4	20,692	7,339	13,353
Texas	1	0	1	37,717	0	37,717	4	0	4	48,568	0	48,568	2	0	2	13,934	0	13,934	6	0	6	19,079	0	19,079
Utah	0	0	0	0	0	0	1	0	1	10,129	0	10,129	1	0	1	5,282	0	5,282	4	1	3	13,228	3,031	10,197
Vermont	0	0	0	0	0	0	1	0	1	24,089	0	24,089	0	0	0	0	0	0	0	0	0	0	0	0
Virginia	0	0	0	0	0	0	1	0	1	22,964	0	22,964	1	0	1	5,875	0	5,875	4	1	3	15,447	4,159	11,288
Washington	2	0	2	421,685	0	421,685	0	0	0	0	0	0	1	1	0	7,549	7,549	0	0	0	0	0	0	0
West Virginia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wisconsin	0	0	0	0	0	0	1	0	1	22,132	0	22,132	5	3	2	32,814	20,499	12,315	10	6	4	37,766	22,062	15,704
Wyoming	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
United States	24	3	21	3,336,889	101,758	3,235,131	71	20	51	1,094,727	326,944	767,783	126	37	89	861,161	255,379	605,782	260	73	187	919,498	262,878	656,620

Municipal Light and Power Systems in the United States by Population Groups—Continued

Segregated as to Systems Purchasing All Their Energy and Systems Generating All or Part of Their Energy

State	Population 1,001 to 2,500						Population 501 to 1,000						Population 251 to 500						Population Under 250					
	Number of Systems			Population Served			Number of Systems			Population Served			Number of Systems			Population Served			Number of Systems			Population Served		
	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part	Total	Purch. All	Gen. All or Part
Alabama	9	7	2	17,304	13,028	4,276	3	1	2	2,302	853	1,449	0	0	0	0	0	0	0	0	0	0	0	0
Arizona	2	1	1	2,511	1,161	1,350	2	0	2	1,475	0	1,475	0	0	0	0	0	0	0	0	0	0	0	0
Arkansas	4	0	4	8,800	0	8,800	0	0	0	0	0	0	1	0	1	264	0	264	0	0	0	0	0	0
California	8	6	2	15,537	12,499	3,038	2	1	1	1,357	683	674	2	2	0	873	873	0	0	0	0	0	0	0
Colorado	7	0	7	8,900	0	8,900	10	3	7	7,126	1,862	5,264	6	5	1	2,001	1,679	322	1	0	1	175	0	175
Connecticut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delaware	3	1	2	5,517	2,183	3,334	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Florida	8	0	8	13,096	0	13,096	3	0	3	2,139	0	2,139	2	1	1	659	326	333	0	0	0	0	0	0
Georgia	25	11	14	42,747	18,317	24,430	11	4	7	9,117	3,495	5,622	1	0	1	422	0	422	0	0	0	0	0	0
Idaho	3	2	1	4,928	3,692	1,236	4	3	1	2,936	2,001	935	3	3	0	933	933	0	0	0	0	0	0	0
Illinois	12	1	11	22,720	1,916	20,804	8	1	7	5,214	518	4,696	3	2	1	1,143	816	327	2	1	1	404	211	193
Indiana	20	13	7	27,891	18,211	9,680	14	12	2	9,237	7,850	1,387	10	9	1	3,671	3,330	341	2	2	0	429	429	0
Iowa	28	7	21	43,440	9,848	33,592	22	14	8	16,634	10,514	6,120	13	8	5	5,070	3,141	1,929	2	2	0	485	485	0
Kansas	38	3	35	62,089	5,399	56,690	37	17	20	26,401	11,253	15,148	16	13	3	5,795	4,424	1,371	5	5	0	1,127	1,127	0
Kentucky	3	1	2	4,442	1,395	3,047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Louisiana	11	2	9	16,619	4,347	12,272	4	1	3	3,220	713	2,507	0	0	0	0	0	0	0	0	0	0	0	0
Maine	0	0	0	0	0	0	1	0	1	934	0	934	1	0	1	374	0	374	0	0	0	0	0	0
Maryland	3	0	3	4,478	0	4,478	1	0	1	968	0	968	0	0	0	0	0	0	0	0	0	0	0	0
Massachusetts	13	13	0	22,397	22,397	0	5	5	0	3,396	3,396	0	0	0	0	0	0	0	0	0	0	0	0	0
Michigan	16	3	13	27,425	6,136	21,289	8	1	7	5,869	969	4,900	6	1	5	2,173	414	1,759	2	0	2	342	0	342
Minnesota	31	13	18	53,513	23,397	30,116	15	11	4	10,820	7,664	3,156	7	7	0	2,423	2,423	0	4	4	0	886	886	0
Mississippi	11	0	11	19,529	0	19,529	3	0	3	2,337	0	2,337	1	0	1	494	0	494	1	0	1	15	0	15
Missouri	23	1	22	42,127	1,868	40,259	4	1	3	3,004	884	2,120	3	2	1	1,191	766	425	0	0	0	0	0	0
Montana	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	344	0	344	0	0	0	0	0	0
Nebraska	34	5	29	51,971	7,344	44,627	45	21	24	32,591	15,169	17,422	52	38	14	19,827	13,861	5,966	12	8	4	2,869	1,550	1,319
Nevada	1	1	0	1,753	1,753	0	1	0	1	545	0	545	1	1	0	328	328	0	0	0	0	0	0	0
New Hampshire	2	0	2	3,453	0	3,453	1	1	0	869	869	0	0	0	0	0	0	0	0	0	0	0	0	0
New Jersey	1	1	0	1,481	1,481	0	1	1	0	634	634	0	2	1	1	629	300	329	1	1	0	117	117	0
New Mexico	1	0	1	2,157	0	2,157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New York	17	7	10	26,478	9,933	16,545	11	8	3	8,759	6,176	2,583	0	0	0	0	0	0	0	0	0	0	0	0
North Carolina	9	5	4	15,060	8,500	6,560	2	1	1	1,217	510	707	2	2	0	596	596	0	2	2	0	386	386	0
North Dakota	3	1	2	3,445	1,183	2,262	3	0	3	2,323	0	2,323	6	0	6	1,895	0	1,895	1	0	1	199	0	199
Ohio	27	13	14	48,759	23,309	25,450	20	16	4	14,759	11,740	3,019	8	8	0	2,978	2,978	0	1	1	0	241	241	0
Oklahoma	23	5	18	39,769	8,025	31,744	12	3	9	8,882	2,104	6,778	4	3	1	1,492	1,016	476	3	3	0	686	686	0
Oregon	3	0	3	5,102	0	5,102	1	1	0	852	852	0	0	0	0	0	0	0	0	0	0	0	0	0
Pennsylvania	9	7	2	15,203	11,168	4,035	3	3	0	2,674	2,674	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhode Island	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Carolina	12	7	5	21,812	12,479	9,333	4	4	0	2,973	2,973	0	1	1	0	429	429	0	0	0	0	0	0	0
South Dakota	7	1	6	9,417	1,113	8,304	7	3	4	4,946	2,121	2,825	13	4	9	4,551	1,344	3,207	3	2	1	496	376	120
Tennessee	7	0	7	13,105	0	13,105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Texas	11	0	11	15,516	0	15,516	6	1	5	4,585	821	3,764	3	0	3	1,181	0	1,181	0	0	0	0	0	0
Utah	8	0	8	14,201	0	14,201	1	1	0	634	634	0	3	3	0	1,001	1,001	0	0	0	0	0	0	0
Vermont	9	3	6	13,935	5,006	8,929	3	2	1	1,830	1,149	681	1	0	1	368	0	368	1	1	0	221	221	0
Virginia	5	0	5	9,179	0	9,179	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Washington	4	4	0	5,854	5,854	0	3	2	1	1,945	1,425	520	2	0	2	686	0	686	0	0	0	0	0	0
West Virginia	4	0	4	6,495	0	6,495	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wisconsin	34	20	14	56,580	31,784	24,796	21	13	8	15,374	9,304	6,070	5	4	1	1,850	1,541	309	1	1	0	153	153	0
Wyoming	2	1	1	2,346	1,065	1,281	4	2	2	3,201	1,502	1,699	2	0	2	836	0	836	1	0	1	150	0	150
United States	511	166	345	849,081	275,791	573,290	306	158	148	224,079	113,312	110,767	181	118	63	66,477	42,519	23,958	45	33	12	9,381	6,868	2,513

Ohio, with its million people. Of necessity the whole population has in all cases been included.

The population figures are in general the latest available from the U. S. Census at the time the directory was prepared; for the smaller towns they are those of the 1920 census; for the larger cities, the Census Bureau's more recent published estimates were adopted.

A table in the ELECTRICAL WORLD for March 17, 1928, on page 553, shows 1,973 municipal systems. The difference of 451 is to be ascribed to two main causes. One is the gradual absorption, proceeding at the rate of about 200 a year, which tends to make each succeeding figure smaller than the one before it. The other and more important is the inclusion, in the earlier summary, of systems not listed in the directory and regarding which no information was available beyond the mere mention of their names in state commission reports or other reliable sources. It is safe to assume that, possibly with rare exceptions, they are in very small places. Experience shows that responses to requests for statistical information generally vary in proportion to the importance of the system, whether private or municipal; the larger ones reply promptly and fully; those from which no information can be obtained represent only a negligible percentage of the total service, whether in terms of population, in number of customers or in financial operations. Their omission or inclusion, therefore, affects the totals but slightly.

Before-Climbing Test for Poles

IN ORDER to insure that poles are safe to climb it is the practice of the Milwaukee Electric Railway & Light Company for the lineman to make a more comprehensive test of the pole than the usual visual inspection and superficial probing. Since records show that poles set for less than ten years are quite safe the common procedure is considered sufficient; it is only on the poles older than ten years that the test here outlined from the report of the accident prevention committee, Great Lakes Division, N.E.L.A., is used

All poles or guy stubs of greater age than ten years must be tested by linemen before being climbed by boring a ½-in. hole 2 in. deep at the ground line on two sides and probing with a 10½-in. steel point provided for the purpose to ascertain the internal condition. If a pole is found to be in satisfactory condition after boring and probing, the holes are creosoted and plugged with creosoted cedar pins. A dated nail showing the year of the test is then driven into the pole below the number tag or nail showing previous test. Following this procedure the pole may be climbed during a period of two years as indicated by the dated nail without further test than visual inspection unless such inspection discloses defects. At the expiration of two years it must again be subjected to the boring and probing test prior to climbing, care being exercised to bore and probe in the same places as was previously done.

If, after boring and probing, a pole is considered unsound a red nail marked "B," signifying bad, is driven below the number tag. The pole is immediately ordered replaced and no climbing is done on it until it has been sufficiently braced and guyed to insure safe working conditions.

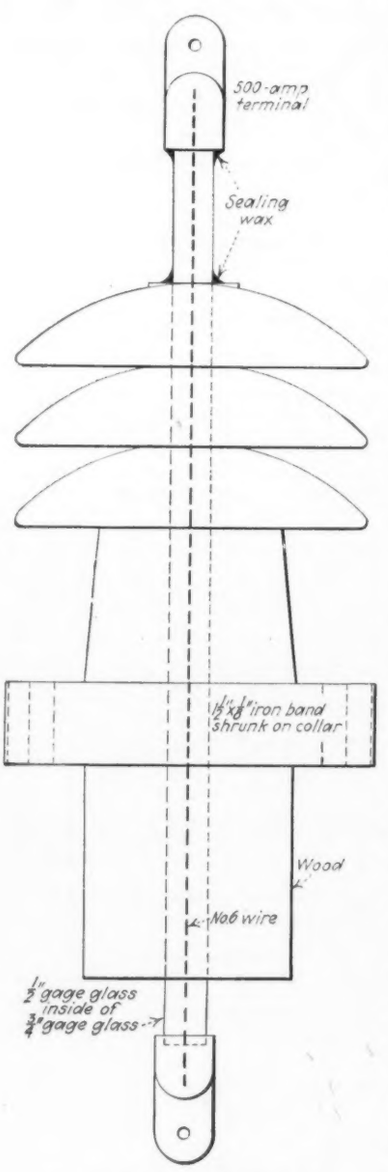
Experience has shown that the most serious decay often occurs at a point a few inches below the ground line. For this reason the test is usually made just below the ground line, and where this cannot be readily accomplished, because of frozen ground or concrete surrounding the pole, the test holes at the ground line are bored downward at an angle of approximately 45 deg. In any field test safety in the pole condition and strength becomes a matter of the lineman's judgment, acquired only through experience.

The age of all poles on the system is determined by the number tag which each pole carries, all line foremen being provided with information indicating the numbers corresponding to poles set each year. Men engaged in switching operations or trouble work are not required to test poles by boring and probing, but are required to make the usual visual inspection.

Making a Temporary Bushing for 22-Kv. Service

BY DONALD COCKBURN

Carleton-Mace Engineering Corporation, Boston, Mass.



Turned maple bushing for transformer lead-in

IN EMERGENCY service where three transformers with star-connected primaries wound for 11 kv. had to be operated on a 22-kv. line, a high-tension bushing on one transformer failed after three weeks' operation, grounding the lead-in on the case. A spare terminal was not available without considerable delay, so the writer made a temporary bushing by turning a piece of treated maple on a lathe, soaking it in hot transformer oil for three hours, and giving it three coats of insulating varnish. A $\frac{13}{16}$-in. hole was drilled through its center and a ¾-in. gage glass inserted, the length of the glass being 18 in. Inside this another gage glass ½ in. in diameter was inserted and a piece of No. 6 copper wire run through the inner glass tubing. The upper end of the gage glass was sealed into the bushing. The temporary bushing operated without any trouble until a standard bushing could be obtained.

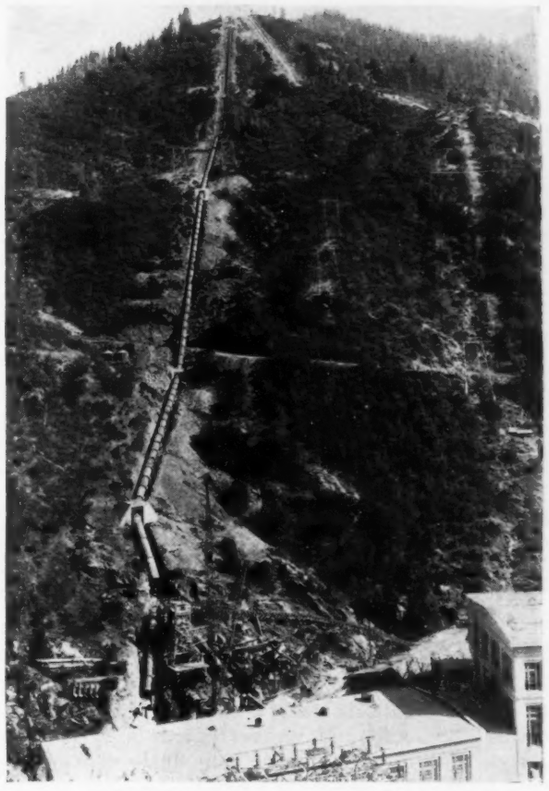
High Head and Large Units

at Big Creek 2-A

Additional water storage utilized in 90,000-kva. plant. High-speed field excitation and large WR^2 factor aid in system stability

WITH the completion of Big Creek No. 2-A plant of the Southern California Edison Company 90,000 kva. of additional hydro-electric generating capacity was added to the company's system in September of this year. Its completion brings the total number of plants on the Big Creek-San Joaquin project in Fresno County, California, up to five, with an installed generating capacity of 457,700 hp., and marks a temporary economic stopping point in this extensive development. Additional generation for the immediate future, at least, may be provided by steam. Steam-electric power is now more economical in southern California than hydro power and already the Edison company has embarked upon an extensive steam expansion program, the first 90,000-kw. unit of a plant of 800,000-kw. ultimate capacity having been placed in operation during June.

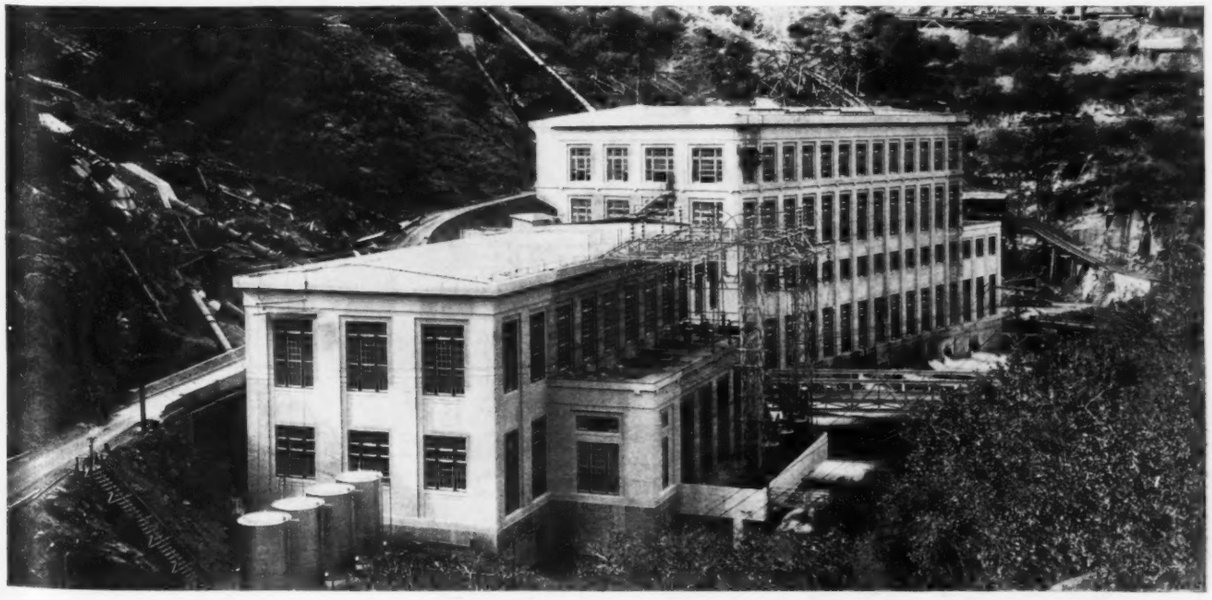
Big Creek No. 2-A is notable because of its high static head of 2,418 ft. and the large capacity of the two double-overhung impulse waterwheel units. One of the prime movers was supplied by the Pelton Water Wheel Company, the other by the Allis-Chalmers Manufacturing Company. Each is rated at 56,000 hp. and drives a 45,000-kva. Westinghouse generator.



Penstock delivers 600 sec.-ft. of water under 2,418-ft. static head

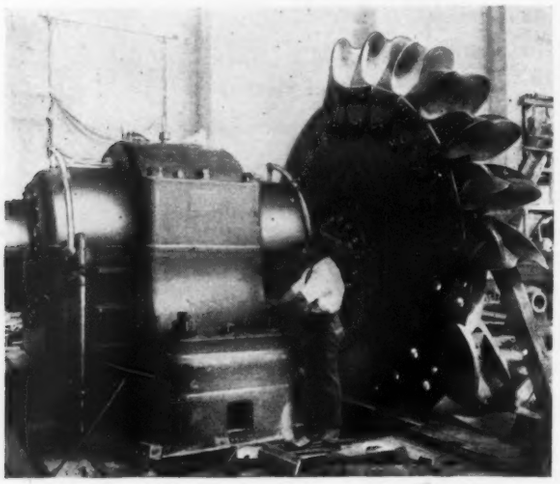
The 600 sec.-ft. of water required for the plant is taken from Shaver Lake, which has a storage of 138,000 acre-ft., most of the water being derived from other watersheds by means of tunnels. From Shaver Lake a tunnel approximately 13,880 ft. long connects with a single penstock leading to the power house.

The penstock consists of 1,858 ft. of riveted-steel pipe at the upper end, a central portion of 3,042 ft. of banded,



Two 56,000-hp., double-overhung impulse waterwheels operating under 2,290-ft. effective head are housed in Big Creek No. 2-A plant (foreground)

forge-welded pipe and a lower section of 1,764 ft. of forged seamless steel pipe, the thickness of the latter at the lower end being 3 in. The penstock branches into four 34-in. lines entering the power house at an angle of 30 deg., the water from the nozzles impinging upon the waterwheels at the same angle. Inside the power house are four gate valves of the follower-ring type, permitting a smooth and uninterrupted flow of water when open, due to the follower ring filling the position occupied by the disk when the valve is closed.



One of main bearings and waterwheels of 56,000-hp. Allis-Chalmers unit

The bearing is 32 in. x 48 in. and is of the self-aligning, ball-and-socket, ring-oiling type, said to be the largest bearing of this type ever built. The waterwheel will develop 28,000 hp. under an effective head of 2,290 ft.

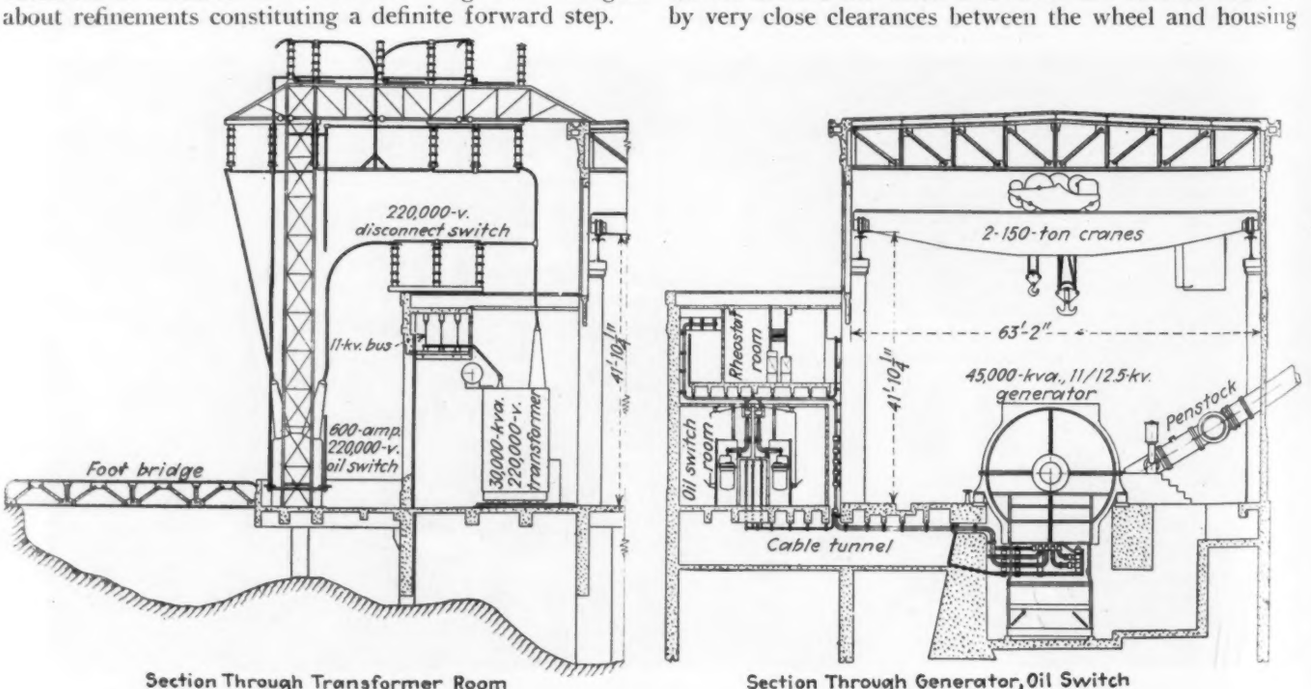
The two double-overhung impulse waterwheels were made to operate under identical hydraulic conditions and were designed to reach the highest attainable efficiency, since a bonus will be granted for efficiencies in excess of the guarantees. This situation stimulated both manufacturers to research in waterwheel design and brought about refinements constituting a definite forward step.

In the Pelton design one of the important features is the straight-flow nozzles which provide a straight flow of water through the nozzle body with no deflection. The needle stems are supported in specially designed guides inside the nozzle body, these ribs acting as vanes, which assist materially in removing eddies remaining in the water at this point. Relief valves mechanically interconnected with the main nozzles are provided to care for sudden load rejection. The relief valves may be operated either "water-saving" or as synchronous bypasses and may be operated by hand or by a motor mechanism. The governor has a direct-connected mechanical drive operated through a set of spiral and a set of bevel gears interconnected by a ball-bearing countershaft. The stroke of the governor is adjustable with a minimum of 2 seconds for full stroke. This, as well as the Allis-Chalmers governor, will reject full load on the generators with approximately a 30 per cent speed increase.

A feature of particular interest in the Pelton design is the elimination of the usual wye connection to the valve body to accommodate the relief valve. The usual wye connection destroys the stream-line flow, but with the new design the nozzle bodies have an annular manifold cast as an integral part of the nozzle body, which manifold connects to the relief pipe. Energy from water passed through the relief valve as well as from jets at runaway speed is dissipated by vortex baffles mounted in each wheel pit.

Another feature of design, not peculiar to this unit, however, is the demountable bucket-ring construction employed. The hubs are permanently pressed onto the shaft and the removable bucket rim is mounted on these hubs by means of six taper bolts. This construction greatly facilitates repairs and makes possible a complete change of buckets in some eight hours, as against a very much greater time required where hub and bucket rim are cast in one piece. Bearings are of the rigid type, water cooled and provided with bronze oil rings.

In the Allis-Chalmers unit a system of baffles in the wheel house has been provided to prevent water being carried around the wheel and losses are further reduced by very close clearances between the wheel and housing



Section Through Transformer Room and 220-Kv. Rack

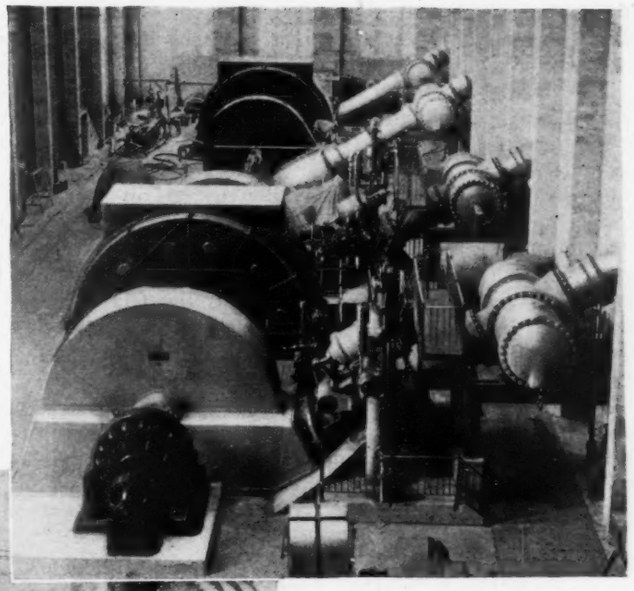
Section Through Generator, Oil Switch and Rheostat Room

Section through Big Creek 2-A power house and 220-kv. switch rack

to reduce windage. Bifurcated nozzle bodies are used so that the needle stems will not interfere with the stream-line flow of water through the nozzles. The needle stem projects back into the space provided by the split construction where it engages the governing mechanism.

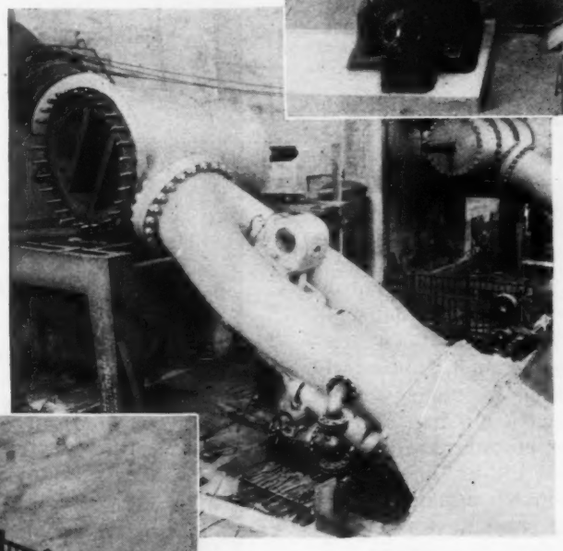
A jet deflecting nozzle actuated by a governor-controlled servo-motor is provided to take care of sudden load rejection. Energy of the deflected jet as well as that of the full jet at runaway speed is absorbed by a special baffle or energy absorber mounted in each wheel pit. The double-belt driven governor has an adjustable opening time and a full-stroke closing time of 3.5 seconds. Bearings are of the self-aligning, ball-and-socket, ring-oiling type.

Design of the Allis-Chalmers as well as the Pelton unit and their accompanying generators is such that the speed may be increased from 250 r.p.m. (50 cycles) to 300 r.p.m. (60 cycles) at a later date should it be desired to feed the output of the plant into the company's 60-cycle system.

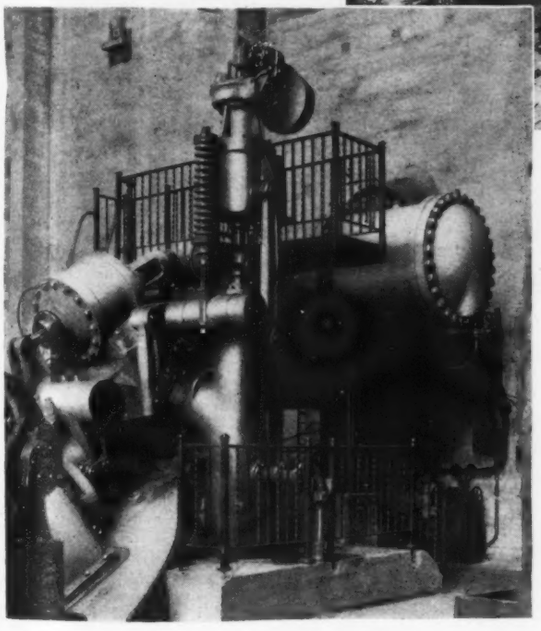


Interior of No. 2-A power house

The four follower-ring valves which are so designed as to offer no obstruction to the flow of water are shown.



Bifurcated nozzle body on Allis-Chalmers unit designed to maintain stream-line water flow



Pelton governor, straight-flow nozzle and relief valve body

Big Creek 2-A power house, a building of steel and concrete, is located immediately adjacent to power house No. 2, as may be seen from one of the accompanying illustrations. The difference in height of the two buildings represents the comparative building requirements for indoor and outdoor high-tension equipment. The No. 2 plant, built in 1911-12, has a height of 100 ft., as compared with 61 ft. for the new plant. In the old plant high-tension transformers and oil circuit breakers are installed in the building, while in the newer plant this equipment is all of the outdoor type.

The two generators are rated at 45,000 kva., 11-12.5 kv., and operate in parallel on a single low-tension bus through duplicate sets of oil circuit breakers. The low-tension terminals of a 90,000-kva. transformer bank are solidly connected to the low-tension bus. A single oil circuit breaker on the high-tension side of the transformer bank ties the plant into the 220-kv. system through a short transmission line leading to the main 220-kv. bus at Big Creek plant No. 3, 6.25 miles downstream. Although control of the new plant is centered in the older plant, the transmission circuits of the two are entirely independent.

The generators have two features of note, a high-speed field excitation system and an unusually large stored energy factor, both provided to aid in system stability. The high-speed field excitation is of the pilot-exciter type, wherein the main exciter receives its field excitation from the pilot exciter. The main exciter units for each machine are rated at 375 kw. and the pilot exciters at 4 kw., both being mounted in tandem on an extension of the main generator shaft. The response of the field excitation system is so rapid that the 45,000-kva. generators will automatically pick up from no load to full load in 1.6 seconds. Control may be transferred to manual or block load control if desired. Each generator and waterwheel unit has a WR^2 factor of 15,400,-

000 ft.-lb., which will aid materially in the generator's ability to maintain synchronism in cases of system disturbance, particularly if of a minor character.

The cooling system is of the inclosed circulating air type, the air passing through water-cooling coils in the generator pit. Fire protection has been provided by CO_2 gas automatically released from successive cylinders to maintain the necessary concentration of gas in the inclosed ventilating system.

Differential relay protection is provided for each generator as well as for the main transformer bank. In addition, overload protection is provided by CO relays which trip the main 220-kv. circuit breaker. Directional phase-to-ground protection also is provided which operates to trip the 220-kv. breaker.

The new plant is notable for its simplicity and features which make for reliability of operation and will form an important producing unit in the Edison company's Big Creek chain of plants.

Distributing Tower Steel

AN IMPORTANT element in steel tower erection, one that may easily mean one more or one less tower per gang per day, is the manner of handling the steel from the yard to the tower site. Too often the steel is taken from the yard with no adequate check on the pieces and thrown helter-skelter on the ground, no one knowing whether or not a complete tower has been delivered to each location. Time is lost while a man walks a quarter of a mile or so and rummages through a disorderly pile of steel at the next location while his mates wait on a half-erected tower for a piece that is missing.

To eliminate this condition, the Hoosier Engineering Company, during the building of a 132-kv. line for the Indiana & Michigan Electric Company, initiated a very workable system for handling and checking tower steel. Mimeographed sheets of the form here shown were provided for each tower. Each sheet contains an itemized list of quantities and descriptions of pieces necessary for

HOOSIER ENGINEERING CO., CHICAGO, ILL.

TOWER DISTRIBUTION SHEET — JOB NO. A.G. & E. CO. #101.

TOWER NO. 17 — TYPE BX.

NO. PCS.	MARK	SHAPE	CHECK ON	CHECK OFF	NO. PCS.	MARK	SHAPE	CHECK ON	CHECK OFF
1	XBX	Le 6" x6" x19'- 0 1/4"			2	B60	Le 2" x2" x 5'- 7 1/2"		
3	BX5	Le 6" x6" x19'- 0 1/4"			5	B61	Le 3" x2½" x 1'- 6"		
6	BX6	Le 2" x2" x25'- 1"			4	B62	Le 3" x2½" x 1'- 6"		
9	BY	Le 3" x3" x 9'- 1 5/16"			2	B63	Le 3" x2½" x 1'- 6"		
8	B6	Le 3" x3" x10'- 9 5/8"			1	B64	PLATE 5" x 6'- 6 7/8"		
8	BX9	Le 2" x2" x 6'- 0 1/16"			2	BX65	Le 3" x3" x28'- 6 1/4"		
4	B	x 9'-10 3/4"			2	BY	A'- 6 5/16"		
		'- 1 1/4"							
2	B49	Le 6" x3" x				B66	Le 2½" x2½" x 1		
2	B50	PLATE 5" x 1'- 1 1/4"			8	BX66	Le 2" x2" x 4'- 6"		
2	B51	Le 4" x3" x28'-5			8	BX67	Le 4" x3" x25'- 2"		
2	B52	Le 5" x3" x14'-4 3/8"			8	BX68	Le 4" x3" x23'-10"		
2	B53	Le 5" x3" x18'-10 7/8"					BOLTS		
6	BX54	Le 2" x2" x 3'-5 1/8"			76		5/8"x1 1/4"		
2	BX55	PLATES 5" x 0'-6"			97		5/8"x 1 1/2"		
2	B56	BARS 2½" x 6'-3 7/8"			117		5/8"x1 3/4"		
2	B57	" 3½" x 6'-4 11/16"			29		WASHERS 1 1/8"x1/8"x1½"		
2	B58	Le 4" x3" x 1'-2 5/8"			16		LADDER RUNGS.		
4	B59	Le 2" x2" x 5'-5 3/4"							

DISTRIBUTED BY:_____ DATE:_____

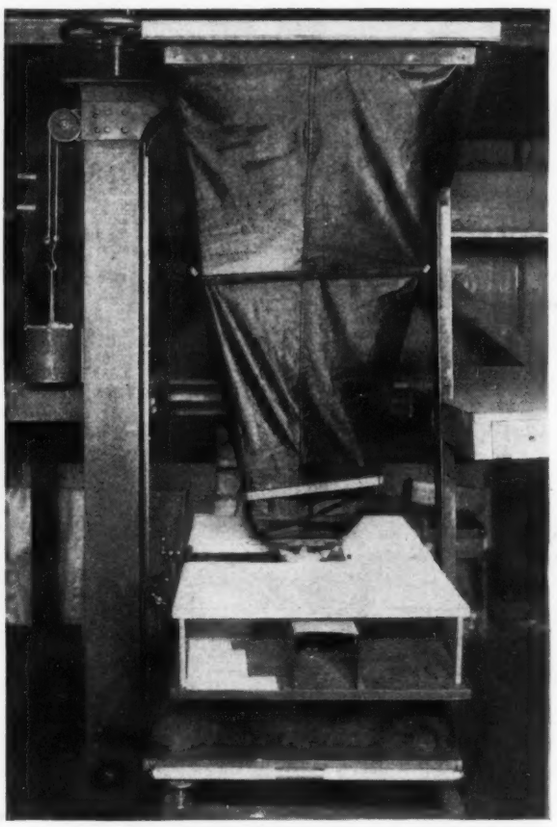
Form for checking distribution of tower steel

a complete structure. The forms are different for each type of tower, but each sheet includes supplementary lists for 10- and 20-ft. extensions above standard tower heights.

When the steel is loaded at the yard each piece is checked on the truck and is again checked when the truck is unloaded at the job. All of the pieces are laid on the ground in an orderly manner so that the ground men after short experience know exactly where to pick up the piece the erectors will need next. The sheets are signed by the man who distributes the steel so that documentary evidence is at hand in case of complaint by the erecting crew.

Economical Map Enlarging

EQUIPMENT for enlarging maps accurately without excessive cost has been devised by C. E. Sims of the West Penn Power Company. The machine illustrated was built in a local shop at a cost of $1,400 complete



Tracings of maps to enlarged scale made rapidly and economically by this device

with lens, lamps and screens. With this machine one man can develop and trace a minimum of four sheets per day and the cost of making up map sections has been reduced to one-twenty-fourth of the cost by pantograph methods.

The section of topographical sheet to be traced is pinned to the drawing board at the lower part. Two 500-watt projection lamps, located above and slightly to the side of this topographical sheet, by means of reflectors cast their light upon the section of topographical sheet to be enlarged. A Bausch & Lomb lens is held parallel and a few inches above the section of topographical sheet. The image of the topographical sheet is projected to a drawing board with a glass center 24 in. x 36 in. and is traced by a draftsman who stands on the platform around the machine. The correct scale is obtained by having a line of known length on the topographical sheet and turning the adjusting wheel until the line on the image is of the proper length at the scale desired.

Determining
Transmission Line Losses

Graphic method for estimation of losses on extensions simplified. Application of charts to specific problems illustrated and formulas derived for essential factors

By S. Murray Jones and Joel Tompkins
Southeastern Engineering Company, Birmingham, Ala.

IN STUDYING transmission systems, both for present conditions and for future extensions, it is often desirable to determine the annual losses in transmission lines. The amount of these losses depends not only on the load factor and maximum load on a line and on the resistance but also on the shape of the particular load curve applicable. Two load curves having the same load factors and the same maximum values could very well give somewhat different values of yearly loss on exactly similar lines. Despite this fact, it has been found possible to develop a curve which gives the relation between load factor, loss at peak load and total annual energy loss.

Such a curve has been found of considerable value in planning for future extensions on the system of the Southeastern Power & Light Company. The yearly value of line losses is an important consideration in justifying new lines, new synchronous condensers, etc.

Derivation of Curve

Consider a load curve, as may be illustrated by Fig. 1. Here kilowatts are plotted against time. The ordinates may also be considered as current if constant voltage and constant power factor are assumed.

Let t = time; i = r.m.s. current per phase at any time, t (assuming a three-phase line), and r = resistance per phase of line.

Then the total energy loss in the line in the time, T, is

$$\text{Loss} = 3\int_0^T i^2 r\,dt \qquad (1)$$

As r is considered a constant, it may be taken outside of the integral sign. Then

$$\text{Loss} = 3r\int_0^T i^2\,dt \qquad (2)$$

The expression under the integral sign is equal to the area under the squared current curve from time zero to time T, which is equal to T times the average ordinate of the squared current curve, by the definition of the average ordinate.

$$\text{Then: Loss} = 3 \cdot r \cdot (\text{Average squared current}) \cdot T \qquad (3)$$

The average current may be introduced as follows:

$$\text{Loss} = 3rT \cdot \frac{(\text{Average squared current})}{\text{Square of average current}} \cdot (\text{Square of average current}) \qquad (4)$$

It may be seen that expression (4) is equal to (3).

For convenience, let the constant k be defined as:

$$k = \frac{\text{Average squared current}}{\text{Square of average current}} \qquad (5)$$

From the definition of the load factor (in terms of current),

$$\text{Load factor} = \frac{\text{Average current}}{\text{Maximum current}} \qquad (6)$$

$$\text{So that: Average current} = (\text{Load factor})\ (\text{Maximum current}) \qquad (7)$$

$$\text{Substituting in (4), Loss} = 3rTk\ (\text{Load factor})^2\ (\text{Maximum current})^2 \qquad (8)$$

$$\text{Also } 3r\ (\text{maximum current})^2 = P_m, \qquad (9)$$

Where P_m is the three-phase power loss at the time of maximum r.m.s. current over the line.

Let the load factor be denoted by $L.F.$ Then

$$\text{Loss} = P_m Tk(L.F.)^2 \qquad (10)$$

The constant k, as defined above, may be determined for any load curve. If a large number of load curves are studied, it may be found that k varies fairly regularly with the load factor, and varies from unity at unity load factor to above 1.5 for lower load factors found in practice.

The load curves of eight 110-kv. lines and of one generating station of the system of the Alabama Power Company were studied and load factor and constant k, as defined in (5) were determined for each. The different lines were chosen because of their varying type of service. The values found are shown plotted in Fig. 2. The points shown include both monthly values and resultant yearly values. Although there is considerable diversity among the points, a definite trend is observable and is fairly well represented by the curve drawn.

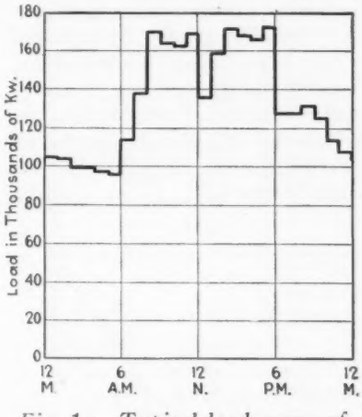


Fig. 1 — Typical load curve of Alabama Power Company

Consider again equation (1). Let the constant C be defined as

$$C = Tk\ (L.F.)^2 \qquad (11)$$

As the total yearly energy loss is desired in kilowatt-hours, and the maximum loss would be in kilowatts, T must be in hours, so that T is the number of hours in a year. For each value of load factor and k, as found above, the constant C may be found. If now C is plotted against load factor, as shown in Fig. 3, all the points fall fairly well on a smooth curve.

Use of the Curve

From a consideration of equations (10) and (11), it may be seen that the yearly loss:

$$\text{Kilowatt-hour loss} = P_m C \qquad (12)$$

Then for any study it is necessary only to determine also the load factor. Then by using the curve, Fig. 3, the constant C may be found and by using equation (12) the annual energy loss may be determined. By assigning the maximum current and the maximum power loss and a definite unit cost to this loss the annual value of losses may be determined and the result used in economic studies.

It may be noticed in Fig. 3 that for 100 per cent load factor C is equal to 8760, the number of hours in a year. This might be expected, for with a load which does not vary the total loss would be equal to the kilowatt loss

multiplied by the number of hours in a year. For 100 per cent load factor k is unity.

The curve in Fig. 3 is based on the type of load curve found on the Alabama Power Company system, a typical one of which is shown in Fig. 1. Consequently before applying it to any system with load curves which depart appreciably from this general type it should be checked at several points.

For load factors between 50 per cent and 100 per cent, the points on Fig. 3 fall fairly well on the curve and the percentage error in C that may be expected from the use of the curve is relatively small, about 10 per cent or smaller, with the possible percentage error decreasing as the load factor is increased.

For load factors below 50 per cent the diversity of the points increases, and the possible percentage error increases, although even here the curve fairly well represents average conditions.

For a study of future extensions the results that may be obtained if the error is only about 10 per cent are close enough, because the future loads, power factors and load factors must be estimated. These estimates are difficult to make and may very easily involve errors of much more than 10 per cent.

Check for Curve

To provide a check on the use of the curve a study was made on the North Auburn-Newnan 110-kv. line, which is a tie-line between the systems of the Alabama Power Company and the Georgia Power Company. At each end of this line there are two integrating kilowatt-hour meters, one to meter outgoing energy and one to meter incoming energy. From the records of the meters the total energy loss in the line for the eight months of Sept. 1, 1926, to April 30, 1927, was 3,700,000 kw.-hr. During this period the maximum load, as metered at

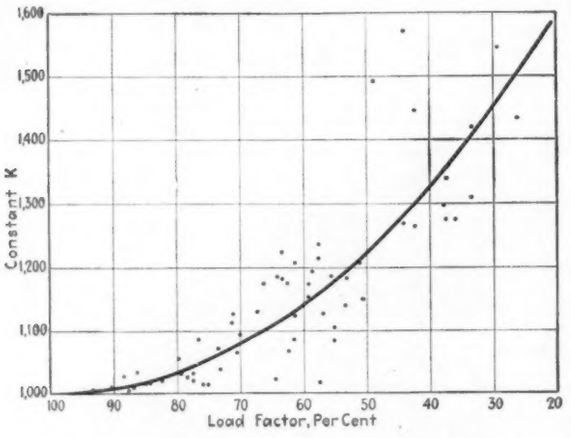


Fig. 2—Chart for finding constant "k" for any line load factor

North Auburn, was 47,520 kw. and the total energy over the line, both incoming and outgoing, also metered at North Auburn, was 89,758,600 kw.-hr. These figures give a load factor of 32.3 per cent. With the resistance of the line of 25.87 ohms and a voltage and power factor measured at North Auburn as 112 kv. and 100 per cent respectively the maximum loss was found as 4,660 kw. From Fig. 3, with a load factor of 32.3 per cent, the value of C may be found as 1270. Then the total energy loss is

$$0.667 \times 1270 \times 4660 = 3{,}950{,}000 \text{ kw.-hr.} \qquad (13)$$

The figure 0.667 was used because the period taken was only eight months, or two-thirds of a year.

The calculated value agrees well with the actual measured value, as there is only a 6.8 per cent error. However, the accuracy obtained is not quite as good as might appear on first sight, because the measured value of losses includes insulator leakage, corona and loss through induction in the overhead ground wires, of which there are two. Although the power loss in the ground wires is extremely small, as it is of the order of 2 kw. under

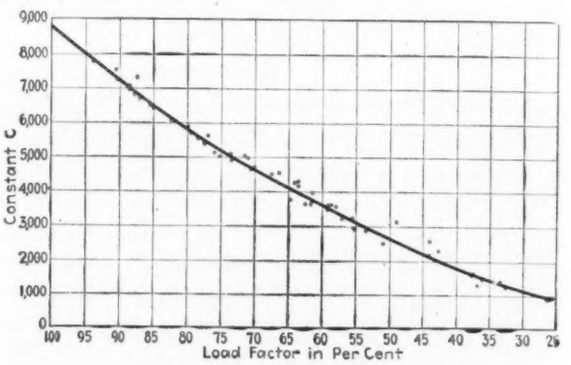


Fig. 3—Yearly line loss diagram

Yearly kilowatt-hour loss = kilowatt loss (maximum) × C

maximum load conditions, the total energy losses by all three means may be as much as 70,000 kw.-hr. The calculated value of losses includes only the I^2R loss in the conductors, and hence, as such, is in error slightly more than the amount shown by the difference of the calculated and measured values, as the calculated value is greater than the measured value.

The example taken gave a rather low load factor and involved a portion of the curve for which only a relatively few points were obtained. The North Auburn-Newnan line was not used in deriving the curve, so the check obtained is quite good. For the purposes for which the curve is used it gives results which are easily sufficiently accurate.

The curve shown in Fig. 3 may be used in determining the total yearly copper loss in transformers when the maximum copper loss and the load factor are known. The core loss is usually taken as a constant for constant terminal voltage, so that the total yearly core loss may be found by multiplying the core loss by the number of hours in a year. The yearly energy loss in a transformer is the sum of the core and copper losses.

Cost of Installing Curve-Drawing Meter on Tie Line

(New England Central-Station System)

One combined curve-drawing wattmeter and reactive kilovolt-ampere meter, with motor drive and quick-trip attachment, scale 7,000-0-23,000 kw.	$398.40
Miscellaneous material	6.54
Transportation	8.34
Blueprints	0.43
Switchboard panel mountings	13.18
Terminal boards, metal cleats, etc.	8.18
Labor	260.83
Expenses, miscellaneous	28.33
Engineering services	43.45
Total	$767.68

Trial by Implication*

Inference of misconduct arising from investigation of power industry menaces confidence on which all business is based

By M. D. Smiley

Vice-President First National Bank, Appleton, Wis.

GENTLEMEN, in coming here to meet with you tonight I have surrounded my movements with the greatest secrecy, and yet I shudder lest through some oversight my presence become publicly known. As a banker I am jealous of my standing in this community and am diligent to guard my reputation. And you, gentlemen, I regret to say, stand under a cloud. You are under suspicion. You are being investigated. Perhaps you are not all guilty, but that I do not know. Perhaps in due course there will be some of you with whom I can associate in public, but in the meantime my reputation and standing are in your hands and I beg of you to protect me.

Gentlemen, I can sympathize with you. Senator Walsh's original resolution presented to the Senate called for a senatorial committee to investigate the industry to see if any abuses existed and suggest legislation to cure such abuses if found. If by abuses we mean acts and policies which may from time to time work contrary to public policy, I think I am safe in admitting to you that in the conduct of the investment banking business, to which I devote my activity, we, too, have occasional abuses. And I think it is fair to surmise that if representative leaders of the several lines of business activity were to testify here tonight they too would admit knowledge of certain abuses which crop up from time to time in their respective fields. But you can well imagine my feelings on picking up the paper some morning should I see that request had been made for a senatorial committee to investigate the investment banking business to learn if any abuses existed and to suggest that legislation be enacted to correct such abuses as might be found.

> *"The indictment is blazoned in the headlines; the dismissal without guilt is hidden among the advertisements. . . . The suspicion that something is wrong is impressed on the public, while the finding that nothing serious is wrong receives scant attention. . . . You men in the power industry are now faced with the problem of how to correct the unfavorable publicity and propaganda that are being offered as a result of the present investigation."*

Regardless of the scrupulous care with which I may have conducted my business, the very appointment of such a committee and the beginning of such an investigation would, in the eyes of the public, constitute an indictment of my business and would harm it incalculably, even though the upshot of the investigation would be a clean bill of health for me. The indictment is blazoned in the headlines; the dismissal without guilt is hidden among the advertisements. And in the same degree, the suspicion that something is wrong is impressed on the public, while the finding that nothing serious is wrong receives scant attention. To use ex-Senator Lenroot's illustration before the Interstate Commerce Commission of the Senate, let a woman's chastity be questioned in public hearings and her position in the community is ruined during the investigation and even at its conclusion with the charges disproved.

An investigation of an industry for the purpose of determining if any abuses exist puts the industry somewhat in the position of the man forced to answer with a "Yes" or "No" the question "Have you stopped beating your wife yet?" The very foundation of such a far-reaching investigation is based on suspicion of existing abuses, and by nature of the scope of the investigation that suspicion is leveled at every one in the industry. That, gentlemen, it seems to me, is the bane of an investigation such as has been launched at your industry. No one of you, regardless of how scrupulously he has conducted his particular business, escapes the general indictment leveled at the industry as a whole. Properly conducted in a constructive spirit, the results should be beneficial to the public and the industry alike. Improperly conducted by a political body in a spirit of carping criticism and the results of such an investigation are of little, if any, use to any one. The action of the Senate in transferring the present utility investigation to the non-political Federal Trade Commission was laudable. How much more praiseworthy would have been the action had the scope of the investigation at that time been confined to one or two phases of the business which were of particular public concern instead of permitting the utility industry as a whole to come under the mantle of suspicion.

Any Business Depends on Public Good Will

Gentlemen, the successful conduct of my business and the successful conduct of your business or of any business depends on the confidence and good will of the public. It behooves me and it behooves you so to conduct our business at all times as to merit this confidence and good will. And if any of you, as part of my public, suspect me of engaging in practices contrary to public good or particularly if you do not suspect me but suspect my neighbor, who is also in the investment banking busi-

**Address to Electric Section Convention, Wisconsin Utilities Association.*

ness, of such practices, then I maintain you have the right to learn the facts. I also demand that you frame your suspicions in such language and conduct your investigation in such fashion as to leave me enjoying the confidence of the public and my customers until I have been proved guilty of willful wrongdoing. That, gentlemen, is, I think, a protection to which every business and every industry is entitled. Failure to grant such protection does injure business by undermining confidence.

Reduced to every-day English, the Federal Trade Commission is investigating the methods used by the light and power companies in combating government ownership and operation of public utilities, and after it exhausts the possibilities of this excursion it will investigate the capitalizations of these same light and power companies. It is not at all concerned with the correctness or incorrectness of the facts presented to the public; it is concerned only with showing or attempting to show that public utilities are engaged in propagating their point of view on an enormous scale. It is in no wise concerned with the fact that the proponents of government ownership and operation are engaged in propagating their own point of view on an enormous scale. Not at all. The hearings are, above everything else, *ex parte,* and under the Senate resolution ordering the investigation were never intended to be anything else.

Commission Is in Defence of Itself

I realize only too well what the commission is up against. It is fighting for its very life. It has been under a constant fire of criticism. The commission has heard Senators who have heretofore been its stanch supporters condemn it in terms which are both rhetorical and vicious. It knows that unless it does something, and that unless that something is sufficient to carry on the front pages of the newspapers, it will be subject to a still more vicious attack and may even be completely wiped out of existence. Therefore, it is following the line of least resistance and trying its best to give the taxpayers their money's worth.

The defendants, the public utilities of America, are accused of propagating their point of view with regard to government ownership and operation of power projects. In other words, they are accused of attempting to prove to the public that they can operate their plants more efficiently and for less cost to the public than the federal government can operate them. Incidentally, they are accused of trying to retain ownership of the properties they have built up, although it is generally admitted that they are willing to submit to state control and regulation. The purpose of the trial is to divorce the managers of those properties from public sympathy. They are accused of seducing newspapers, magazines, writers and educational institutions by fattening the treasuries of these publications and institutions and the pocketbooks of the writers with a portion of their ill-gotten gains. The correspondents in the case are the press, the writers and the institutions, but they have no standing in court and no adequate means of defending their names in the record.

It must be frankly recognized that the injury arising from an investigation is the *public reaction,* usually formed by the reading of startling headlines and distorted versions given in a few of the newspapers. It should be remembered that such an impression lingers long in the minds of the public even though the charges made are disproved and the defendant acquitted. You men in the power industry are now faced with the problem of how to correct the unfavorable publicity and propaganda that are being offered as a result of the present investigation.

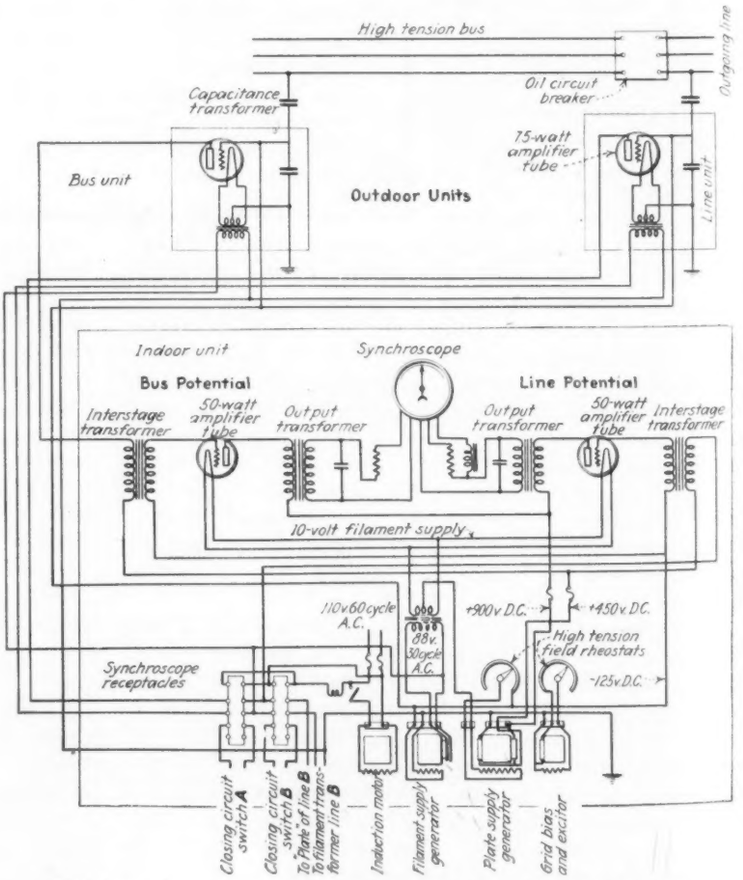
Vacuum Tube Synchronizing Proves Advantageous

By C. Q. Wiggins

Production and Transmission Department, Tennessee Electric Power Company

VACUUM tube synchronizing is one of the latest applications of radio equipment to power system operation, eliminating the necessity for high-voltage transformers, high-voltage fuses, etc., which would otherwise be necessary to step the transformer voltage down to 110 for the operation of a synchroscope.

A small coupling condenser is used with two stages of audio-frequency amplification. The coupling condensers are installed in the metal ring of standard high-voltage bushings. The bushings may be a part of the oil circuit breaker or one bushing may be mounted in a small tank of oil and connected to the line or bus, as the case may be. The coupling condenser receives a



Wiring plan for vacuum tube synchronizing equipment used on Tennessee system

small charge by induction from the current in the metal core of the bushings. This small current is stepped up by a one-stage amplifier, located near the bushing, and carried to the switchboard, where it passes through another stage of amplification to bring it up to 110 volts. It will be seen that vacuum tube amplification may be used on "machine-starting" circuits or with a potential transformer installation on "machine running," or vice versa.

A four-unit motor-generator set together with suitable transformers furnishes the filament, grid bias and plate voltages. A five-pole receptacle with bayonet type plug makes the necessary connections to the synchroscope, closes the closing circuit of the "machine starting" circuit breaker and starts the motor-generator set through a small clapper switch located on the back of the panel.

An installation of this nature has been in operation at the Ocoee No. 1 hydro-electric plant of the Tennessee Electric Power Company on the Ocoee River in southeastern Tennessee for over a year. The maintenance cost has been practically zero and the operation has been highly satisfactory.

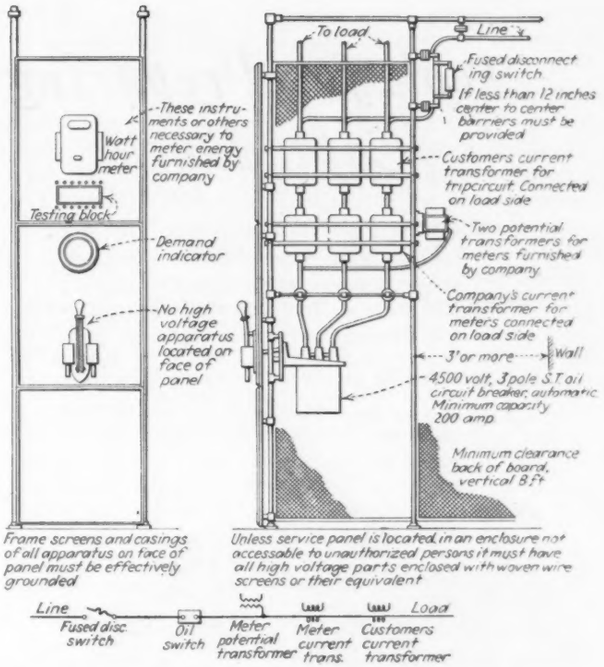
Standard Meter Panels in Industrial Substations

By W. L. Wadsworth
Superintendent of Meters, Northern States Power Company, Minneapolis, Minn.

IN INDUSTRIAL substations serving customers with energy at 2,300/4,000 volts it is the practice with the Northern States Power Company, Minneapolis, Minn., to furnish only metering apparatus and the cable pothead on the service pole, which latter is installed by the company at the expense of the customer. All other equipment is supplied by the customer. The substation vault is built and the equipment installed by the customer's contractor according to rules and instructions of the power company.

The work done by the contractor includes the installation of the company-owned metering equipment. This has been found to be more satisfactory and economical to both parties than for the contractor to break the continuity of his work to leave space and wiring provisions for the wiring and installation of metering devices by power company men. The company simply turns over to the contractor the necessary meters, test blocks and instument transformers for him to install as a part of his job. When the service is ready for connection a meter inspector checks over the instrument wiring and that is all there is to it.

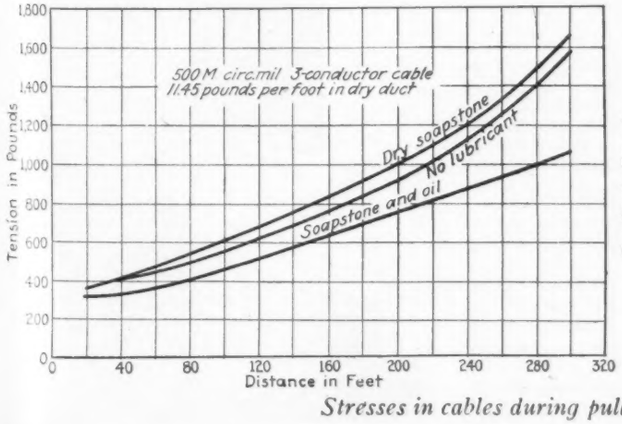
The accompanying sketch, prints of which, together with detail drawings, are furnished by the company to the contractor, shows the simplicity of the usual installation of standardized panels.

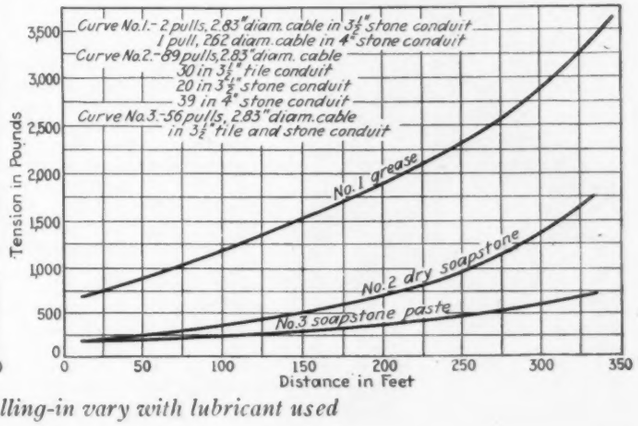

To load
Line
Fused disconnecting switch
If less than 12 inches center to center barriers must be provided
These instruments or others necessary to meter energy furnished by company
Watt hour meter
Testing block
Demand indicator
No high voltage apparatus located on face of panel
Customers current transformer for trip circuit. Connected on load side
Two potential transformers for meters furnished by company
Company's current transformer for meters connected on load side
3' or more
Wall
4500 volt, 3 pole S.T.oil circuit breaker, automatic. Minimum capacity 200 amp.
Minimum clearance back of board, vertical 8 ft.
Frame screens and casings of all apparatus on face of panel must be effectively grounded
Unless service panel is located in an enclosure not accessable to unauthorized persons it must have all high voltage parts enclosed with woven wire screens or their equivalent
Line
Fused disc. switch
Oil switch
Meter potential transformer
Meter current trans.
Customers current transformer
Load

Standard panel—three-phase, 2,300/4,000-volt service to large industrials

Cable Pulling Stresses

THE two curve sheets here reproduced show cable pulling stresses with different lubricants as determined by tests made by the Commonwealth Edison Company and presented in the 1927-28 report of the underground systems committee, Great Lakes Division, N.E.L.A. The chart at left refers to cable pulled into fiber duct; that at right to stone ducts. The mixture of soapstone, oil and grease represented by curve 3 in both graphs is a cable pulling compound manufactured by the Minerallac Company. In stone duct 5 to 6 lb. of this mixture was found to be as effective as 40 lb. of grease.



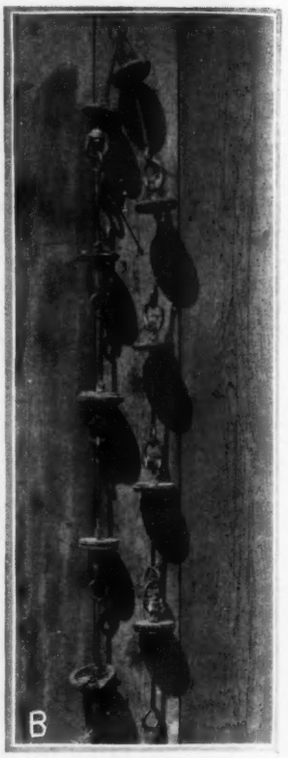


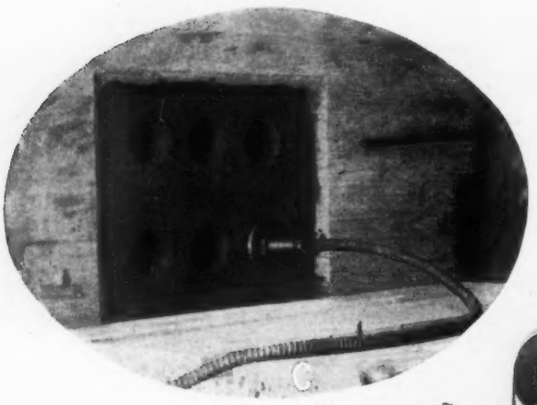
Stresses in cables during pulling-in vary with lubricant used

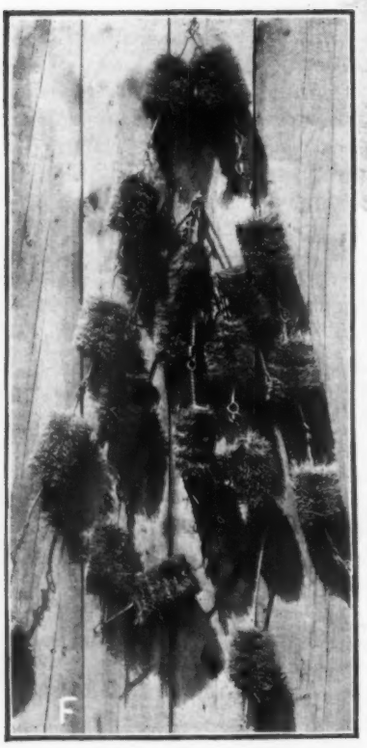
Tools for Preparing Cable Ducts

SOME of the equipment used by the New York Edison Company in preparing underground ducts for the cable is shown in the accompanying illustrations.

A—Two types of wooden mandrels used to test clearance of ducts and remove large obstructions. The longer mandrel is used in connection with sectional rods, while the shorter mandrel with the eye is pulled by a power winch on the truck. B—These flexible rubber-lined plungers when pulled through a charging box filled with soapstone carry enough with them to deposit a thin film on the ducts. C—Air line used to blow out any collection of dust and sand. D and E—Apparatus for blowing soapstone lubricant into ducts. The short hose connection is inserted in the box of soapstone. A more recent development of duct lubrication is the use of a mixture of oil and soapstone applied to the cable during installation. F—Articulated brushes are pulled through the ducts to remove loose sand and pebbles that might abrade the cables. The diameter of the brushes is such as to prevent excessive scouring.







Will the Farmer Use More Power?*

Answers to this question obtained by analyzing the needs, desires, attitude and economic status of 1,800 New York farmers in 50 counties

By R. F. Buckman
Farm Management Department, State College of Agriculture, Cornell University

INFORMATION collected in New York State from 1,800 farm users of electricity representing 50 of the 55 agricultural counties discloses some interesting facts. Two-thirds of them obtain their power from utility systems; the others from individual farm plants. This is virtually the proportion that exists when all New York farm users of electricity are considered: 43,200 on utility service; 20,000 using home plants. The farmers who use electricity for milking machines consumed 93 per cent more energy per year than those who do not. Ten per cent of this increase may be due to the fact that the farms with milking machines had four more outlets per farm than those without. None of the increase can be due to a difference in household appliances, for the farms without the milking machines had a slightly greater wattage of appliances than the ones with them. While there is a great variation in the size of milking-machine motors (ranging from $\frac{1}{6}$ hp. to 3 hp.), the average farmer using one may be expected to consume about 1.3 kw.-hr. per day in summer and approximately 0.85 kw.-hr. per day in winter. He wants an uninterrupted supply of energy available between the hours of 5 and 7, both morning and afternoon.

The farmer with a large dairy farm, producing cash crops in addition to milk, is the most generous user of electricity. Eight of these farms averaged over 1,000 kw.-hr. a year. When the records were sorted without reference to size, the straight dairy farms were in the lead. Poultrymen had the most expensive job of wiring and the heaviest lighting load. Fruit farmers had the greatest wattage of household appliances; in fact, there were enough fruit farms with two electric flatirons each to make the total number of irons greater than the total number of fruit farms. The combination dairy and poultry farms used the least amount of energy, but since these were rather small, the size of farm rather than the type was responsible for the low consumption.

About one-fourth of the farms studied were using lights for egg production. Ninety-five per cent of these farms had lights during December, January and February; three out of four used them during November and March. Thirty per cent of the farmers used lights both morning and afternoon and 60 per cent in the morning only. The afternoon load comes on about sundown, at a time of peak demand. The use of automatic time clocks for switching on the lights in the morning and a heating element to keep the water from freezing would make possible earlier morning lighting. For the poultryman this would eliminate the problem of dimming. It might be desirable to offer special inducements to poultrymen to use lights in the mornings only, at an off-peak period. Farms with fewer than 300 hens per farm used 536 kw.-hr. a year at a cost of 11.7 cents per unit; those with more than 1,000 hens used 814 kw.-hr. and paid 10.6 cents per unit. Those who used lights both morning and afternoon used nearly twice as much energy as those who did not.

The value of electric service to the farmer makes rural electrification of constantly increasing significance

Under most of the block rates, and especially under the rates which have a differential in favor of power and range users, the poultryman is at a disadvantage. The new inducement rates offered by some of the utilities are proving very attractive to poultrymen. One was seriously considering a large incubator of the non-electric type. When he was assured that an inducement-type rate was going through he purchased a 13,000-egg electric machine. During the month of March he used 751 kw.-hr. Under the old rate schedule his bill would have been $67.59; with the new one it was $32.63. But this is not all; he has just installed an electric range and is in the market for a refrigerator.

Reasons for Limited Use Analyzed

To test the validity of the reasons given for not using more energy, the amount used by those giving each reason was studied. Out of 335, 193 gave no reason; they were using 574 kw.-hr. a year. Forty-eight gave various reasons, but were using more energy than those who gave no reason; those reasons were therefore considered inconsequential. Interruptions to service were named as the chief objection to great use of service, but these occurred in only two cases. Thirty-one reported

*Abstract of address presented before Commercial Section, Empire State Gas and Electric Association.

a lack of funds, but did not seem to find fault with the cost either of energy or appliances. Cost of energy seemed to be more of a deterrent than cost of appliances. However, few farmers who were paying less than 13 cents a kilowatt-hour gave this reason.

Statistical analysis was made of some of the records to determine the importance of various factors in causing variations in the amount of electricity used annually. Up to date six variables have been measured. These are total acres in the farm, number of cows, number of motors smaller than 1 hp., number of motors of 1 hp. or over, number of outlets and the amount paid per kilowatt-hour. Those six factors account for 67 per cent of variation.

An increase of 10 per cent in the total acres per farm is responsible for an increase of 1 per cent in the amount of energy consumed. An increase of 50 acres, with all other factors remaining constant, would cause an increase of 26 kw.-hr. a year. This is the least important of the six variables; in other words, size is not well measured by acreage.

For a dairy farm the number of cows measures the size of the business; every additional cow is good for 12 more kilowatt-hours per year. A 10 per cent increase in the herd would cause a 4½ per cent increase in energy used.

Fifty-two kilowatt-hours a year would be added to the average farm consumption if there were one small motor per farm instead of 0.56, which was found as an average; if there were one motor of one horsepower for every two farms instead of one to every four as at present, 80 more kilowatt-hours per farm would be used.

The number of outlets per farm seems to be the best measure of energy consumed. A 10 per cent change in this factor is responsible for a 7 per cent increase in energy. Every additional outlet is good for 10 more kilowatt-hours annually.

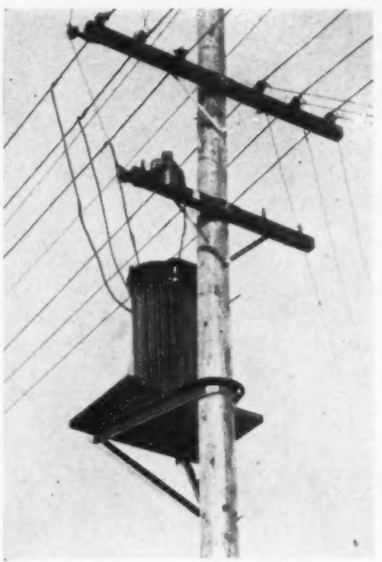
Rates Are an Important Consideration in Rural Energy Use

The average amount paid per kilowatt-hour was 11.6 cents when a simple average was taken. A weighted average gave 9.3 cents. Variations in this factor were less effective than any of the others except acres per farm. However, a drop from 11.6 cents as a simple average to 8 cents would increase consumption per farm by 90 kw.-hr.

When the farms were classified according to their supply of power (i.e., company), there were many variations in connected light, number of motors, wattage of household appliances and annual consumption that could not be accounted for by the type of farming in the franchise area concerned. New York State has such diversified farming that the average farm is not a typical one. For these reasons a study of averages will not give results that can be applied to any specific farm, but the results may serve as a guide or standard of comparison. Rural electrification is dynamic; the standards of today will be sadly out of date in five years. Standards for each type of farm should be set and kept up to date. Records should be accumulated over a series of years, and the data should be correlated with the economic conditions for the type of farming concerned. With such information available, it would be relatively simple to forecast the probable load for a new extension and would be less difficult to plan effective methods for building up loads on existing farm lines.

Single-Pole Transformer Platform

By T. A. Robinson
Distribution Department,
City of Winnipeg (Canada) Hydro-Electric System

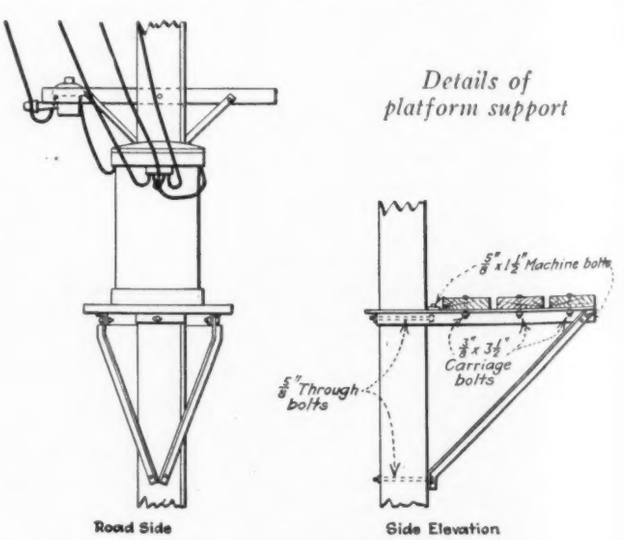


Single-pole transformer platform in service

FREQUENTLY a utility may have several platform-type transformers in stock which, for some reason or other, are not suitable for bank operation. These, however, would be satisfactory for single-phase lighting service if some means of pole mounting could be devised. The method here described is interesting, utilizing a small all-steel single-pole platform, the main angle of which is bent around the pole so that the floor planks are placed across its two ends.

The platform foundation consists of a standard 3-in. steel angle $\frac{5}{16}$ in. thick bent at the center with a radius of 6 in. so that the ends of the angles are 2 ft. 6 in. apart. A crosspiece, of 3-in. steel angle, is cut to fit across the face of the pole and bolt to the main angle at each side.

The braces consist of standard 2-in. angles and are designed to make a 45-deg. angle with the pole and structure. For flooring three pieces of 2-in. by 10-in. plank 3 ft. 6 in. are used. The main angle is held at the back to the pole by a $\frac{5}{8}$-in. through-bolt which also



Details of platform support

passes through the crosspiece in the front. The braces are held by $\frac{5}{8}$-in. through-bolts. The braces and crosspieces are bolted to the angle with $\frac{5}{8}$-in. by 1½-in. machine bolts and $\frac{3}{8}$-in. by 3½-in. carriage bolts are used to hold the flooring. This expedient has proved to be entirely satisfactory and has been used for some time.

Construction Cost Estimates—

What They Stand On

Knowledge of project, coupled with use of standard method of setting up conditions and specifications for construction, eliminates inconsistencies in estimating

An Interview with
H. W. FULLER
Vice-President Byllesby Engineering & Management Corporation

H. W. Fuller

H. W. FULLER, who is in general charge of construction on all the far-flung utility properties under Byllesby control and management, has accumulated some very positive ideas on the art of estimating costs for construction. He emphatically refuses to consider estimating as more than one of the useful arts, an art that a competent operator, furnished with the tools of his trade, can use to reach exact results. Much of the trouble in setting up costs for projected construction has been that the estimator has not been furnished the proper tools to work with, according to Mr. Fuller. These tools are a definite and complete detailed knowledge of the projected structure, an adequate record system that will first define and then assemble and correlate items of the estimate, and a compendium of unit cost figures.

The first requisite knowledge of the proposed construction is not the estimator's responsibility. It is up to those who authorize the construction. If they do not make their decisions and stick to them—and frequently enough they don't—it is their fault if the estimate runs over or under the actual cost. The two other tools should also be furnished to the estimator. If estimates for different constructions, or parts of them, are to be compared, it is obvious that they should be set up in uniform terms. Therefore a definite form of estimate record should be provided to all estimators. If his experience has been comprehensive enough and he has a good memory, the estimator may supply his own unit costs. It is much better, however, that these costs should be the actual records of previous jobs, analyzed to their units and set down on paper. These may easily cover a much larger experience than any one man's life can hold and they should be available, not from the memory of one man but from files of tabulated data.

Standard Procedure Formulated

To the end that cost estimates for new constructions may be as nearly correct as the fallibilities of humanity will permit and that estimates made by different persons will be consistent each with all the others, there has been set up in the Byllesby Engineering & Management Corporation a standard procedure for this work. The two desiderata, accuracy and consistency, which are actually one, are attained by removing from the estimating process as much of the human capacity for error as is possible. This is done by the use of standard methods in setting up the conditions and specifications of structures, of systems, of checks and counterchecks that guard against errors and omissions and of an indexed record of previous costs analyzed to their fundamental units.

Mr. Fuller went on to say:

"The estimation of construction costs has too long been a matter of inspiration. I say this about public utility practice only and make no comment about general construction and contracting, because I am in the public utility business and not in the other. But I have the impression that the engineer who goes into a trance and emerges with a total figure for his estimate is a more frequent person in the former field than the one who makes a detailed analysis of a proposed job and uses an adding machine to reach his total.

"Public utilities are responsible to the people they serve. The accounting of this responsibility is through regular channels. These channels, whether they are reports, requests for permissions and authorizations or what not, are prescribed by law or by the rulings of regulatory bodies. Detail is here insisted upon. If it is not provided the regulatory bodies can compel it by their own authority, through the courts or by making it a political issue. The details of financing and operation, being thus subject to scrutiny, are so arranged by account classifications that examination of them is, well, perhaps not exactly easy, but certainly not as hard as it might be. So far as the inherent complexity of the business will allow, the examination of its operating and financial affairs has been facilitated.

"This is not generally true of just as important a branch—construction. Construction cost estimates

largely determine financing. Should they not be based on as solid and as firm a foundation as it is possible to make for them? Estimates are, as a rule, so flexibly erected and so little standardized that no one expects two engineers, working independently, to reach exactly the same figure for total cost of the same structure. Why shouldn't they reach exactly the same figure? There is no reason why they shouldn't, but there is a reason why they don't. They are not working out the problem along the same lines and with the same data. They are not, but they should be.

No Magic in Estimating

"It is generally accepted that setting up a figure for the cost of a structure is almost an occult art—something akin to astrology or clairvoyance—a gift with which Heaven has blessed some men and has denied others.

"Once in a while we hear of a mathematical prodigy, perhaps a five-year-old boy who can name prime numbers until his hearers fall exhausted or who can multiply numbers in the millions while a college professor is reaching for his lead pencil. The prodigy cannot tell how he reaches the solutions he gives. All he knows is that he knows the answers. A lot of estimating is done in the same way. After a little preliminary whirring of its wheels, the engineer's mind clicks to a figure that is his estimate or what it will cost to build a power house. Oh, yes, add 10 per cent for contingencies."

Mention of the word "contingencies" appeared to bring the hammer down on a particularly sore thumb, for Mr. Fuller proceeded to utter a number of feeling remarks on this subject:

"To the average engineer contingencies mean 10 per cent and he adds that amount to every estimate. Now, contingencies vary on different classes of work, due to seasonal and climatic conditions, to labor situations, and to many other factors. Contingencies are risks, and if that word were used instead of the longer one possibly greater attention would be paid to its nature. The risks of unforeseen expenditures are greater, or less, on one job than on another; it is rather absurd to allot a sum of money for this item on an invariable percentage of the total cost of the job.

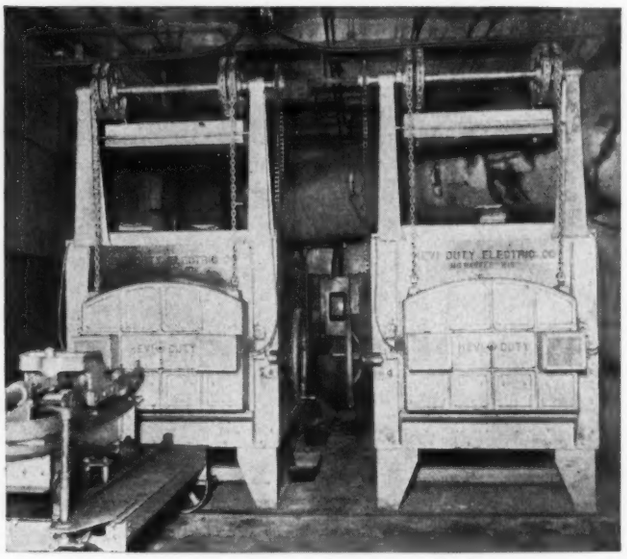
"Another abuse of the contingency item was revealed in the case of an engineer who uniformly kept his contingency fund intact, never had to touch it. When his job was finished he would modestly accept congratulations that his record was not broken. On questioning as to how he rang the bell with such unfailing regularity, he could not explain the reason. However, study of his estimates showed that all of the items in them would probably have been made a little lower by another man. This being drawn to his attention, he said that he always added a little to each item so he wouldn't be taking any chances. He did not regard the chances of what might occur to single items as contingencies. No, contingencies only meant that he was instructed to add 10 per cent to the total estimate.

"Estimating is simply one of the useful arts. Given the tools of that art in the forms of adequate information on the project in hand, of a standard method of procedure and of a sufficient collection of data on costs of previous constructions, one intelligent human being ought to make as good a job of it as another. There is no hocus-pocus about estimating, no magic in it; we have let ourselves think there is too long.

"It is not contended that correct estimating can be made so simple as to dispense with the need of skill based on intelligent knowledge and broad experience in the use of recorded data. But it is certain that, given an accumulation of properly classified and defined cost data relating to the entire range of construction with which we deal, the estimator should be able to produce results free from the major inaccuracies now existing. This is the object of the Byllesby standard classification of construction accounts, which has been earlier referred to."

Electric Heat Anneals Magnetic Iron

AN ESSENTIAL factor in the satisfactory operation of telephone equipment is the quality of iron used in magnetic circuits. This commercially pure iron must have certain definite magnetic characteristics and these characteristics must be uniform throughout the production of the metal. Quality and uniformity are assured



Electric furnaces for annealing magnetic iron

in the magnetic iron produced by Automatic Electric, Inc., Chicago, Ill., by the use of electrically heated annealing furnaces.

The two furnaces, here illustrated, are rated at 105 kw. each and are operating on 220 volts direct current. Six annealing pots with their contained iron stampings or turned coil cores, a gross weight of 2,700 to 3,200 lb., constitutes a charge for each furnace. The variation in weight of gross charge, caused by difference in the nature of metal treated, affects the working cycle in some degree; that is, time of charge and energy requirements will vary.

Starting with the furnace at room temperature, it has been found that four to five hours' time is required to reach the annealing temperature of 900 deg. C. (1,650 deg. F.). The furnaces are loaded late in the afternoon and the electric current is switched on at 6 p.m. by automatic time clock control and switched off again by the same control at a predetermined hour, depending upon the weight of the charge. The total time of heat is usually six to seven hours. When the pots are unloaded the following day just prior to reloading, the furnace temperature usually stands at about 690 deg. C. (1,200 deg. F.). The night operation of

the furnaces not only affords an advantageous working cycle but saves demand charges and results in a greater over-all economical operation than obtained with the gas-fired furnaces previously used.

Full automatic control is obtained through the use of time clocks, which at a predetermined hour establish a control circuit through Leeds & Northrup potentiometer record controllers. When control temperature is attained the Leeds & Northrup instruments maintain the temperature readily to within plus or minus 5 deg. C. Up to the present time no accurate (meter) check up has been made on power consumption; that is, on kilowatt-hours per pound of metal treated. Two men are employed in packing and loading the pots with time to spare for other duties. An ingenious loading device facilitates the loading and unloading of heavy pots with minimum labor and expense.

Arc-Welded Hangar Less Costly than Wood or Riveted-Steel Construction

SIMPLICITY, through the elimination of all trusses and other forms of roof bracing, brought both economies in construction and greater headroom for the same over-all dimensions at the three arc-welded hangars of the Houston, Tex., airport. The structures are of the all-metal type, corrugated iron sheeting being used to cover the steel superstructure, and are consequently wholly fireproof.

The lowest bid submitted for wood construction hangars was 25 per cent higher than that for arc-welded steel construction and the lowest bid for riveted steel construction was 40 per cent higher. Each hangar is 75 ft. wide, 125 ft. long and approximately 50 ft. high. The arches are made up from channel shape sections cut to form the arch when butted end to end and welded together. The entire fabrication of the arches was completed on the ground. Lincoln "Stable-Arc" welders were used. The design and erection were undertaken by the C. J. Frankel Company.

Letters from Our Readers

Timely Comment on Public Relations Work

To the Editor of the ELECTRICAL WORLD:

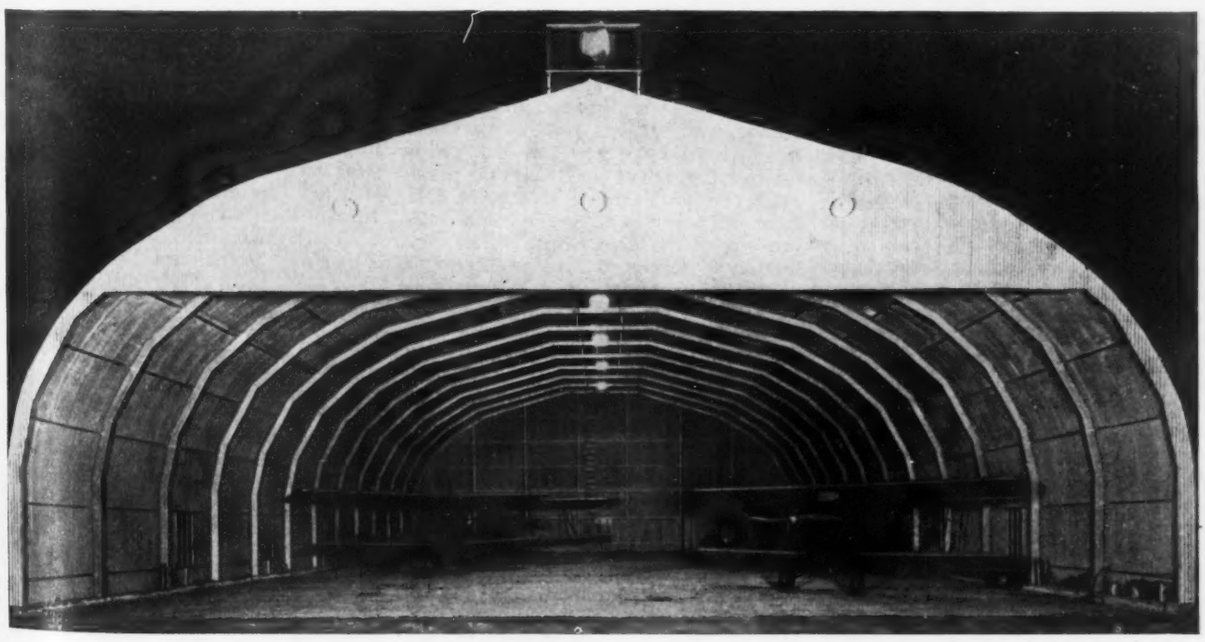
The general policy outlined by Mr. Nutting in his article "Research and Advisory Engineering—An Aid to Sales Promotion," which appeared in the Sept. 15 issue of the ELECTRICAL WORLD, has been followed by the Washington Water Power Company for a number of years and we believe that the results cannot be viewed too optimistically. Mr. Nutting's comment on public relations is very timely. There is absolutely no use in trying to gain the good will of the public through telling it about our work; it knows about our work if we have been doing such work and our advertising should be only of such nature as to call attention to the service we have available.

We have had no such opportunity to obtain large industrial heating loads as those mentioned by Mr. Nutting, but we have carried on extensive work along the lines of power-factor correction and rate application. We make it a point to keep in contact with all industries which have a potential load and we have been very successful in getting new business this way; mostly the electrification of wood-working plants.

There is one phase of this work to which I do not think Mr. Nutting has given quite enough emphasis. That is the contacting of customers through personal calls. We try to call on each of our larger power customers at least every two months. Such calls, as a rule, are merely pleasant visits, but occasionally some small matter comes up which can be settled, and invariably it is these small matters which lead to serious complaints when not attended to promptly. I believe this is one of the best articles that has appeared on power sales work and it should be seriously considered by those utilities which are not following the policies outlined.

EDW. E. SCHOFIELD.

Washington Water Power Company,
Spokane, Wash.



Low construction cost and full headroom features of electrically welded hangar

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Notable Maritime Development Now Operating.—The St. John River Power Company recently placed in operation its Grand Falls generating station. A number of difficult engineering problems had to be solved in this hydro-electric development, which began operation with one 17,500-kva. unit. There are few lakes to act as natural reservoirs for the water supply and the river is subject to violent fluctuations, the maximum recorded discharge being 133,000 sec.-ft. and the minimum being 800 sec.-ft. These extremes occurred within two months of each other and are representative of the seasonal difficulties involved. A high-pressure tunnel slightly more than ½ mile long extends from the intake to the surge tank of the power house. Vertical, single-runner Francis turbines are used and each is protected by a butterfly valve. In the design of this plant all the latest advances in the art of hydro-electric engineering are said to have been taken advantage of in obtaining an efficient and economic design from the viewpoint of construction, operation and maintenance.—*Electrical News (Canada)*, Oct. 15, 1928.

Ohio Falls Hydro Development at Louisville.—HARRISON G. ROBY.—The building of a hydro-electric plant at the falls of the Ohio became possible with the Federal water-power enactment, followed by the growth of a market which could use this secondary power and aided by the design of a propeller type of turbine. Conditions of unusual rise in times of river flood were met with a design of structure that could not be floated from its foundations. This station, with a capacity of 80,000 kw., is said to be the largest in which the units can be operated from a supervisory switchboard and which automatically shuts down when trouble develops on the line. The flow of water available for power generation varies between wide limits and has necessitated unusual engineering steps. It is stated that the adoption of a propeller type of runner contributed largely to the economic possibilities of the plant. The design and control features of the station have been covered in the discussion, as have the economic problems which had to be solved before the station could be undertaken.—*Mechanical Engineering*, November, 1928.

Transmission, Substations and Distribution

Considerations of the Economics of Electric Power Distribution.—W. T. TOWNEND.—An attempt to point out the advantages of combining the production of electrical energy with that of coal byproducts. The author has also made a plea for co-operation between the mine owners and electrical engineers. The discussion applies particularly to conditions in England. It is conceded that recent legislation will have a far-reaching influence, not only throughout the electrical industry, but also in the homes and lives of the people, and that ultimately the recently enacted laws should lead not only to cheaper electricity but also to a greater use of the coal fields as generating centers. The author has considered the various elements entering into the situation and offers a detailed comparison of waste-heat stations and of pulverizing fuel stations on a production basis.—*Journal of the Institution of Electrical Engineers (England)*, September, 1928.

Cable Operation.—The underground systems committee of the N.E.L.A. has issued its annual report upon cable operation in the United States. The records include cable failures on systems operating at 6,600 volts or over for the year 1927. As in previous reports by this committee, the supposed reasons for cable and joint failures have been classified according to a number of major causes and reduced to a basis which permits of ready comparison and assimilation. The failures have been summarized, according to several classifications, for the past nine years and the influence of cable age upon electrical failures has been reduced to a rational basis. Data regarding metal shielded conductor cables and expansion reservoirs and information regarding high-voltage test sets used by various utilities have likewise been included.—*Report National Electric Light Association*, September, 1928.

Overhead Line Design.—J. A. SUMNER.—The question of pole-line design as figured entirely from the viewpoint of the supply engineer has not been adequately dealt with, in the opinion of the author, who presents certain line calculations based upon the claim that, within limits, for standard wood poles the maximum permissible force at a point 2 ft. from the pole top is constant and independent of the pole height. The contention is developed as a result of the consideration of the ideal requirements for the most economical design from the point of stress and includes the consideration of span, pole height and diameter, conductor sag and stress, standard wood poles, and similar factors. A graphical representation of the results obtained in this investigation has been included and certain data tabulated.—*Electrical Review (England)*, Sept. 21, 1928.

French Transmission Line Construction.—R. BARILLOT.—A full description is given of the four main transmission lines for the electrification of the Paris-Orleans railway and power system, extending from the city of Paris as far south as Coindre. There are two main systems, totaling 420 miles, operating at 90 kv., and two other lines, totaling 195 miles, operating at 150 kv., to be increased later to 220 kv. All of the lines are insulated with French-made Hewlett chain type insulators, using six disks for 90 kv., ten disks for 150 kv. and 14 disks for 220 kv. Schematic drawings are given for the straight, angle and anchor steel towers for these four lines, together with the complete transmission line data. All conductors are made of steel-aluminum cables, with one or two galvanized iron lightning cables above. The fourteen element chains for 220 kv. have top and bottom equalizer rings. Careful transposition was provided on all lines to cause a minimum of telephone interference, although no telephone lines are carried on the towers themselves.—*Revue Générale de l'Electricité*, Sept. 29, 1928.

Units, Measurements and Instruments

Mechanical Tests on Turbo-Alternators.—G. LEISTNER.—The revolving fields of high-speed steam-turbine-driven alternators have to withstand enormous mechanical stresses, for which reason the rotor body and shaft as considered in this article are forged from one piece of highest quality alloy steel. To insure a satisfactory quality of steel throughout the forging, the size of which may reach dimensions of up to 36 in. in diameter and 158 in. length, samples are bored out of the piece with hollow drills in places where slots subsequently will be milled out. In this way the material can be tested to a depth of up to 9 in. below its surface. It is also customary to bore out a relatively large sample cylinder all through the axis of the rotor, which provides the further opportunity to inspect the innermost portions of the steel with the aid of specially constructed optical instruments. These furnish their own illumination and give a greatly magnified image.—*Siemens Zeitschrift*, September, 1928.

An Experimental Study of the Corona Voltmeter.—H. B. BROOKS and F. M. DEFANDORF.—This investigation of Whitehead's corona voltmeter, rating 140 kv. effective voltage, was modified in order to improve control of pressure, temperature and humidity. A new and highly accurate method of determining the 60-cycle crest voltage was used in studying this device within a pressure range of three atmospheres and a temperature range of 15 to 45 deg. C. Increase in humidity was found to lower the corona voltage for a dusty or otherwise soiled corona rod, although it generally caused an increase for carefully cleaned rods. Maintenance and

duplication of a given condition of the surface of the corona rod appear to be the factors that limit the repeatability in the present type of instrument. It is suggested that further investigations of the effect of surface conditions would be of great interest. A nomogram devised upon the basis of dry air is described with which the crest voltage for a given set of rods, pressure and temperature may be rapidly determined without any calculation. — *Bureau of Standards Journal of Research,* October, 1928.

Illumination

Airplane Beacons. — X. NEAGELI. — The rapid growth of German air travel forced attention to the necessity of a clear marking of the flying routes during the night and in foggy weather. The chief lanes are equipped with powerful beacons every 18½ miles, with smaller signals in between every 3 miles. The navy type of arc or incandescent searchlight, originally much used, is being rapidly superseded by specially designed neon lamps, the pinkish color of which proved to be not only distinct, but has also much greater fog-penetrating quality. A further advantage of the neon lamp lies in its considerably greater electro-optical efficiency, since it is a much colder light. High-power lamp units have been developed, representing a weatherproof combination of a high-voltage transformer and a glass tube of various shapes. Contrary to expectation, these neon lamps showed a life of 10,000 to 20,000 hours, making it unnecessary to provide automatic or other switching equipment to disconnect them during the daylight hours. To avoid collision of low flying planes with towers, steeples, chimneys, etc., these objects are being equipped with neon warning signs in the shape of vertical tubes. — *Elektrotechnische Zeitschrift,* Oct. 11, 1928.

Heat Applications and Material Handling

Dry Dredge and Bridge Conveyor.— R. SCHROEDER.—The geological location of a large German soft coal vein is such as to extend horizontally, but under a layer of from 50 to 90 ft. of top soil. The mining procedure has been in the past to employ several dry dredges to remove the top soil, to dump it into cars and to haul it away. The extent of the mine is such as to call for a removal of 175,000,000 cu.ft. of soil per year, which necessitated, in the past, many dirt dredges and many miles of railway tracks, operated with 74 men. To insure a modern and much more economic operation a special combination of double dredge and 650-ft. belt conveyor has been built, which accomplishes the above annual output with only 24 men. This equipment has many noteworthy features. To adapt itself to great irregularities of the terrain, the two ends of the main bridge, which are 425 ft. apart, may move to such an extent independently of each other, so that the bridge may be as much as 15 deg. out of line with the tracks. The bridge may rise or fall out of horizontal, or may extend lengthwise up to 10 ft. A total of sixteen motors are required for the dredges, the belt conveyors, the traveling, hoisting, etc. All motors above 44 kw. operate directly on the available 5,000-volt, three-phase overhead trolley supply and all smaller types receive 500 volts through a transformer. Even at moderate velocity the wind pressure against this huge construction is of such magnitude as to make special precautions necessary to avoid too high traveling speed with a wind.—*Siemens Zeitschrift,* September, 1928.

Electrophysics, Electrochemistry and Batteries

The Nature of Gas-Metal Electrodes. —SIDNEY J. FRENCH and LOUIS KAHLENBERG.—Metals form gas-metal electrodes with gases, the potentials of which are specific for the particular metal and gas and are related to the absorbing power of the metal for the gas and the affinity of the metal for each gas, in case of a mixture. The total combination potential is due both to absorbed gas and a condensed film of gas on the surface of the metal according to the determinations made by the authors. Coating electrodes and stirring the electrolyte have the same effect of preventing the condensation of a gas film on the surface of the electrode. This gas film is a definite phenomenon and because of its instability causes fluctuations in potential measurements. The so-called single potentials of the metals, determined as they are in air, are in reality the potentials of air-metal electrodes. The most constant electrodes are those which show the smallest difference between the oxygen and nitrogen potentials. The peculiar behavior of aluminum in the electromotive series is due to the formation of an oxygen-aluminum electrode. Amalgamation and alkali electrolytes permit of the formation of hydrogen at the surface of the aluminum electrode and thus give a much more basic potential. — *Report American Electrochemical Society,* September, 1928.

Traction

Electrification of Steam Railroads.— The committee on electrification of steam railroads of the N.E.L.A. has continued its activities through the past year in accordance with a previously adopted program, namely, to study railroad electrification in a general way, avoiding technical details; to analyze railroad electrifications already made and to develop the fundamental reasons for and the results of those electrifications, and to promote co-operation between the executives of railway and power companies in order to develop a clearer understanding of each other's problems and requirements in connection with railroad electrification. One of the results of this year's work is a tabulation of installations of electrical operation on steam railroad lines throughout the world. The data compiled include the mileage of track electrified, the system installed, the year in which electrification was undertaken, the traffic affected, the reason for electrification and the results which are recognized by operating and executive departments as having been produced by the adoption of this form of tractive equipment. — *Report National Electric Light Association,* September, 1928.

Telegraphy, Telephony, Radio and Signals

The General Characteristics of Induction. — KAZUHO KANAYA. — The problems of induction have been studied by many authorities and particularly the characteristics of induced electromotive force in a communication line caused by neighboring power lines under abnormal conditions. But the need for determinations regarding the relation of induced electromotive force and terminal potential under various conditions has been pointed out by the author, who covers the theoretical aspects of the problem. In oscillographic studies of induction, and also in the measurement of induced voltage with potentiometers, the deviation of phase angles, and the diminution of amplitudes have been the factors leading to further investigation. Six assumptions have been made in order to facilitate the determination.—*No. 231 Researches of the Electrotechnical Laboratory (Japan).*

Miscellaneous

Flash-Over of Insulators. — K. DRAEGER. — With the co-operation of operating companies, the author has investigated the cause of a large number of insulator failures and has found that in only a few rare cases could the breakdown be traced to a puncture failure. Practically all of them were due to flash-overs originated by over-voltages or lightning with the power arc following. The flash-over may be greatly aided by a deposit of impurities upon the porcelain surface, such as dust, soot or bird offal. It is pointed out that the conventional laboratory high potential tests do not simulate actual conditions, since the power output of testing transformers is always low as compared to the vast energies which are set loose in the flash-over arc on a high-voltage transmission system. For this reason the author has made extended tests on insulators with a 22,000-kva. short-circuit generator, furnishing up to 1,200 amp., under a pressure of as high as 17 kv. No ceramic material is known which can withstand the destructive heat effect of a power arc, wherefore arc deflection away from the porcelain surface represents the only way of safe protection. Tests were made with variously shaped metallic caps on the porcelains with good results. — *Elektrotechnik und Maschinenbau,* Sept. 30, 1928.

News of the Industry

Sloan Speaks at Princeton

President of Greater New York's Light and Power Companies Tells Engineering School What a Public Utility Owes to Its Customers

TAKING as his subject "What a Public Utility Owes to Its Customers," Matthew S. Sloan, president of the New York Edison Company and the companies associated with it in supplying electrical service to metropolitan New York, made an address on Thursday night of this week before the faculty and students of the Engineering School of Princeton University at Princeton, N. J.

"A public utility," Mr. Sloan said, "is a business enterprise which reverses one of the common rules of business because, instead of turning over its capital twice or three or four or five times within a year, it turns over its capital on the average once in four or five years. Stated in figures, this means that the gas-manufacturing company or the electric central-station company invests between four and five dollars for each dollar of gross revenue it receives annually from the sale of its service.

"As a public servant, the utility in New York State is required by law to furnish safe and adequate service at fair and reasonable rates. Similar requirements, specific or implied, exist in the laws of other states, and the public regulatory body is the judge of how the utility is complying with these requirements. As a business, the utility is required to produce enough revenue to pay the operating costs for the quality of service which it can merchandise readily, to pay wages to capital sufficient to assure a ready flow of new capital as needed, and to provide some surplus for emergencies. It cannot be a successful and desirable public servant unless it is a business success. There is no conflict of interest in the situation.

"What must a public utility do to be a desirable public servant and a successful business?" Mr. Sloan asked. "First it must recognize its obligations both as a public servant and as a private business; second, it must live up to them—it must live up to them beyond the measure in which other enterprises live up to their business responsibilities and obligations, because it is a public servant."

Mr. Sloan said that a public utility owes to its customers "a physical service as high in quality and efficient in operation as is humanly possible," a management "honest, efficient, economical, broadly human, sensitive to public opinion, possessing an intelligent comprehension of the present and vision for the future," and a service "sold at as low a price as is compatible with the quality of its job." He described the responsibility of the engineer in the manufacture and distribution of the utility's product and for all the physical side of its service, and his further responsibility to keep the utility constantly marching forward by study, research, invention and all other ways.

The rapid growth of interconnection in recent years made possible in large measure the remarkable record of extension of electric service, Mr. Sloan pointed out, saying that this rapid growth "has almost literally covered the country with a network of transmission and distribution lines." He reminded his audience that interconnection is the work of the engineer and that many, if not most, of the smaller communities would be without electric service but for interconnection between electric generating plants and between companies. "Interconnection," he said, "is making possible also the decentralization of industry, which is to my mind one of the major social economic phenomena in respect of which modern electric service may claim credit. The factory no longer has to locate in the large city to be sure of adequate power service."

Fate of Boulder Dam Hinges on Report

Commission of Engineers Likely to Submit Best Findings It Can Before Congress Reassembles—Favorable Verdict May Carry Swing-Johnson Bill Through

By Paul Wooton
Washington Correspondent for the Electrical World

MEMBERS of Congress returning to Washington expect the outcome of Boulder Dam legislation to depend on the report which will be made by the engineering commission of which Major-General W. G. Sibert is chairman. If that commission, which, it will be remembered, was appointed by the Secretary of the Interior in accordance with a resolution of Congress, reaches the conclusion that the project is feasible from an engineering standpoint, there is little doubt that the Swing-Johnson bill will be passed. Not only do returning legislators expect a favorable report to win the votes of many of those who have been against the project, but they also bring word that the utility companies themselves are taking much the same view.

While it is known that one member of the engineering commission is contending that the commission cannot reach an intelligent conclusion in the time allotted, there also are assurances that the other members of the commission are insistent upon complying with the instructions of Congress and submitting the best report that they can on Dec. 3. To do otherwise, it is argued on Capitol Hill, would be equivalent to direct aid to the opponents of the bill. The Boulder Dam measure is the unfinished business and will be the first regular business taken up when Congress convenes. The failure to receive the engineering report might allow the bill to be displaced, and if this were to occur, it would be a valuable asset to the opponents of the bill in a short session of Congress.

It is pointed out that the commission does not have to make recommendations at this time covering the details of the type of structure which can be built under conditions as they exist in the canyon. Under the interpretation placed on the resolution authorizing the commission, it will continue in existence after the submission of its first report. If the first report states conclusively whether or not the project is reasonably feasible and gives the major reasons for that finding, the commission then can develop the details of the structure which its members think can be built successfully under the physical limits existing.

Restoration of San Francisquito Plant Complete

Following seven months' continuous work, the Municipal Bureau of Power and Light of Los Angeles on Nov. 2 placed back in complete operation San Francisquito power plant No. 2, the second largest generating unit in the Power Bureau's system, which was destroyed by the St. Francis Dam disaster last March. Bureau engineers broke several construction speed records.

With its two generators, having a total capacity of 44,000 hp., this plant was almost obliterated on the night of March 13 by the raging wall of water which rushed down San Francisquito Canyon following the destruction of the dam. Twenty-four hours later engineers and laborers were set to work clearing away the débris. The losses suffered by the Power Bureau in damage to power plant No. 2 and because of the hydro-electric energy which went to waste during the time the plant was out of commission amounted to approximately $2,000,000, officials estimate.

Fisk Street's Anniversary

At America's Pioneer Steam-Turbine Generating Station, Belonging to Commonwealth Edison Company, a Quarter Century Is Commemorated

UNVEILING of a tablet commemorating the twenty-fifth anniversary of the starting of the Fisk Street generating station of the Commonwealth Edison Company in Chicago, the first steam-turbine station in America, drew nearly three hundred visitors, representing a large part of the nation's electrical industry, to that plant on Wednesday, Nov. 14. The principal address was made by Samuel Insull, president of the company, who was introduced by Vice-President L. A. Ferguson, the man who laid the cornerstone of the station in 1903. Mr. Ferguson related how he and Frederick Sargent were sent to Europe by Mr. Insull to investigate steam-turbine experiments being made there in 1900 and 1901. From their report and from his own investigations Mr. Insull reached the conclusion that the day of the reciprocating engine as a prime mover in central stations was past and that the turbine would soon displace it.

The story of his negotiations with Charles A. Coffin, then president of the General Electric Company, for a Curtis turbine of the enormous capacity for that time of 5,000 kw. was told by Mr. Insull. The contract was finally made in such a way that the risk of the undertaking was in large part assumed by the central-station company. After a résumé of the growth of turbo-generator-unit capacities and the far-reaching effects of turbine development in all phases of the central-station industry, Mr. Insull said:

"I look back to fifty years before 1930—which would be 1880—when in the factory room of the old Edison Telephone Company of London, on Victoria Street, I saw the first glimmer of an incandescent lamp, burning on about forty cells of Grove batteries. It has been a great privilege and a great inspiration to me personally to have watched and to have taken some part in the development of this great industry in that time. If there are any of my old associates who get any thrill this morning out of this celebration, I can assure them they get no such thrill out of it as I get myself."

Then Mr. Insull unveiled the bronze tablet set into the wall of the station just above the cornerstone. The inscription on the tablet reads:

FISK STREET STATION

The First Steam-Turbine Station in America.
Placed in Operation October 2, 1903, to Serve Chicago with Electricity.
To Commemorate the Pioneering Which Revolutionized Central-Station Practice
This Tablet Is Erected on the Twenty-fifth Anniversary, 1928.

Following the unveiling the guests were transported to a luncheon of the Chicago Association of Commerce, at which P. S. Arkwright, president of the National Electric Light Association, made an address on the civic aspects of the central-station business which met with a hearty response.

Mercury-Vapor Process Scores Success at Hartford

Commercial operation of the 10,000-kw. mercury-vapor unit at the South Meadow generating station of the Hartford Electric Light Company since Oct. 1 has revealed highly gratifying plant economies as obtained from the daily log sheets. The first fire was built under the mercury boiler on Sept. 25; the first delivery of electrical energy to the bus was on Sept. 27, and from the start to Nov. 13 inclusive the mercury unit has delivered 2,920,000 kw.-hr. net to the bus and 38,296,000 lb. of steam at 265 lb. pressure and 730 deg. temperature to the station header. The unit was operated at full load on Oct. 25 and since Nov. 2 has been in continuous daily twenty-four-hour service, carrying an average load of about 7,500 kw.

The over-all coal consumption of the South Meadow station under the load conditions prevailing has been reduced from about 1.5 lb. to 1.1 lb. per net kilowatt-hour delivered to the bus as a result of these few weeks' service. The plant at present contains two 20,000-kw. steam-turbine units in addition to the mercury outfit. The mercury-driven generator has carried during the foregoing period readily controlled loads ranging from the delivery of steam alone to a maximum of 10,500 kw. The initial operation of this pioneer large-scale installation of the mercury-vapor process has required only a few minor mechanical changes having no relation to the process itself. The total output of the station since the mercury unit went into service has been 23,652,000 kw.-hr. through Nov. 13, about one-fourth of this having been supplied by the new equipment in the form of electrical energy and in superheated steam from the mercury condensers.

State Commissioners Show Indignation

Original Senate Resolution, Which Proposed to Investigate Regulating Bodies as Well as Utilities, Brings Strong Condemnation at New Orleans

OPPOSITION to the invasion by the federal government in any manner of the rights of the sovereign states in the control and regulation of public utilities was expressed in strong resolutions adopted by the National Association of Railroad and Utilities Commissioners, which opened its annual convention at New Orleans on Tuesday, Sov. 13. The original Walsh Senate resolution for investigation of public utilities and state public utility commissions was attacked by a number of speakers in the course of the day, which closed with the adoption of a resolution at the night session in which the Walsh resolution was vigorously denounced as a "piece of impudence and impertinence" and an invasion of state rights and the senators who advocated it were termed "monumentally ignorant."

The convention went on record as indorsing the action of the special committee representing the association which appeared before the Senate interstate commerce committee to fight provisions of the resolution opposed by the association. The committee's stand was that it favored investigation of only those public utilities with interstate connections, opposing at the same time the investigation of public utility commissions. The report recognized that the Walsh resolution was then amended in line with the special committee's recommendations and that the Federal Trade Commission is now making this circumscribed probe. The association also approved the statement of the committee as laid before the interstate commerce committee of the Senate in which it declared that the various utility commissions of the United States are willing to give any information concerning public utility regulation to the Federal Trade Commission and feel that the investigation will show that state commissions are doing proper work.

Frank P. Morgan of Alabama, Lewis E. Gettle of Wisconsin, Louis S. Epes of Virginia, O. P. B. Jacobsen of Minnesota and Leonard C. Young of Montana took a leading part in the discussion on the Walsh resolution. Mr. Gettle, who was chairman of the special committee of state commissioners that opposed the Walsh resolution, declared that that resolution, if it had been adopted in its original form, would have created a new federal bureaucracy to supervise public utilities and utility commissions. He said the Walsh resolution was based only on admittedly widespread rumor or suspicion, partly to the effect that "sinister public utility corporation powers" influenced members of the state public utility commissions. Mr. Morgan said that "these self-appointed rate experts in the United States Senate know as much about rates as a goat does about astronomy."

Mr. Gettle, who is chairman of the Wisconsin Railroad Commission, was elected president of the association, and Glacier Park, Mont., was selected as the next meeting place. Other officers elected are: First vice-president, Charles Webster of Des Moines, Iowa; second vice-president, A. J. Maxwell of Raleigh, N. C.; secretary (re-elected), James B. Walker of New York City; general solicitor, John E. Benton, Washington.

The convention will be in session through Friday. About 250 are attending the meeting, including the Canadian Commissioner of Railways.

Sphere of the Wholesaler Is Discussed

National Electrical Wholesalers' Association, Meeting at Chicago, Hears Addresses from Presidents Crouse of the N.E.M.A. and Arkwright of the N.E.L.A.

CALLING upon the wholesalers of the electrical industry to make a new analysis of the processes of distribution, H. B. Crouse, president of the National Electrical Manufacturers' Association, addressed the annual winter convention of the National Electrical Wholesalers' Association at the Hotel Drake in Chicago on Wednesday evening. "The present stage of development in the electrical industry," he said, "shows that there is need for new and deep thinking. Because we have always done some things is no reason why they are today either economic or effective. The only test of the value of the jobber to the industry must be found in proof that he renders a necessary service better or more cheaply than any other agency. If the jobber is big enough to do this kind of thinking and provides this kind of a service, then the manufacturers will arrange their distribution programs to take advantage of this most economic channel for the flow of goods and provide a compensation adequate to the service." Mr. Crouse prophesied a great future for the electrical business in the rewards that come from such a spirit of service.

Preston S. Arkwright, president of the National Electric Light Association, compared the distribution processes in the gas and electrical industries as they affect the power company. It is necessary, he said, for each utility to buy gas ranges in large quantities and to warehouse them, with attendant loss in obsolete stock, interest on investment and endless trouble in handling the details of purchase and delivery; but utilities are entirely free of this responsibility in their purchases of electrical appliances and supplies, for the local jobber provides the stock and carries the entire burden of warehousing. The value of this service had proved itself without question in his home city of Atlanta.

J. E. Otterson, president of Electrical Research Products, Inc., presented the history and development of the talking motion-picture industry, with a demonstration of the present status of the art.

The convention opened on Monday with the meetings of the executive and merchandising committees. C. E. Cullinan, chairman of the executive committee, in his opening address said that 60 per cent of the influences that govern modern business come from without, but that the internal problems of sales, service and finance usually determine whether or not there is a profit. The electrical wholesaler, he said, has been too sales-minded for his own best interest, because in his pressure for volume he has neglected the other factors vital to cost control. He predicted that there will be fewer direct-from-factory shipments in the years to come and a greater attention by the wholesaler to warehousing service and the movement of goods out of the retailer's store.

L. M. Dunn, vice-president Graybar Electric Company, read a paper on salesmen's cars and delivery trucks. F. P. Vose, secretary National Electrical Credit Association, described the Biddle plan for clearing credits, which has been in successful operation in Detroit.

Martin J. Wolf was elected chairman of the Free Lance Jobbers' Club, an informal organization of the independent members of the association.

R. H. Ballard Recipient of Miller Medal

The John B. Miller medal for distinguished service was presented to R. H. Ballard, president of the Southern California Edison Company, at a testimonial dinner held recently at the Hotel Huntington, Pasadena. More than one hundred guests, including directors, officials, department heads and district managers, gathered in the banquet hall to do honor to President Ballard. Following the dinner Mr. Miller, the chairman, presided over an informal program which was brought to a climax by the presentation of the medal.

John B. Miller service medal

Thirty-one years ago R. H. Ballard joined the Westside Lighting Company, from which organization the present Southern California Edison Company traces its source. In 1920 he was made general manager, and in 1924 he became executive vice-president and general manager. In March of this year he was made president of the company. He is the first to receive the John B. Miller medal.

Interstate Engineers Discuss Power Sales

A two-day session of the Interstate Power Club and the New England Central-Station Association of Power Engineers held this week was devoted largely to topics relating to improved power sales activity. Sessions were held in New York on Wednesday and in Newark on Thursday.

Air-conditioning equipment and energy requirements were discussed by R. W. Waterfill of the Carrier Engineering Company, while W. W. Stecker of the United Electric Light & Power Company presented data regarding truck installation in New York. J. L. Faden, chairman industrial heating committee, N.E.L.A., cited the progressive diminution of the production of electric furnaces in the last few years and urged corrective sales activity. H. C. Thuerk, chairman national power committee, N.E.L.A., offered an analysis of the problem confronting the power salesman and pointed out how to meet probable requirements in the future. Electrically heated and controlled stereotype equipment was covered by R. F. Newell, General Electric Company.

C. E. Greenwood, chairman Commercial Section, N.E.L.A., spoke of the assistance that was both available and planned at N.E.L.A. headquarters for power sales organization. Other speakers included E. A. Mills, New York Edison Company; T. G. Coffin, General Baking Company; R. R. Young and H. H. Holding, Public Service Electric & Gas Company, and O. G. Van Campen. Mr. Holding evaluated the importance of surveys in determining power sales activities over considerable periods of time and outlined the work of his organization.

Stephen Bennis, United Electric Light & Power, chairman of the Interstate Power Club, presided. Inspection trips were made.

Rivalry Between Great Quebec Power Interests Foreseen

With the announcement that Frank P. Jones, former president of the Canada Cement Company, had accepted the presidency of the Beauharnois Light, Heat & Power Company, interest has been revived in this company's plans to build a huge canal and power development works on the south side of the St. Lawrence River above Montreal. While the company is well financed for the carrying out of the project, its plans are being opposed by the Holt interests, the Shawinigan Water & Power Company and the Montreal Light, Heat & Power Company, which are intrenched on the north side of the river.

The Beauharnois company is fortified by a charter granted by the Quebec Legislature last session, but the company has still to obtain the approval of the Department of Public Works of the federal government. A public hearing will be held in the near future in Ottawa, but the date has not yet been fixed. The estimated cost of the Beauharnois scheme exceeds $100,000,000. The view has been expressed by some that it will be necessary to await the decision of the Supreme Court of Canada on the question of ownership and control of water powers on navigable streams before granting further concessions for power development on the St. Lawrence. There may be a merry battle between powerful interests before the matter is finally settled.

More Electrification Plans

Officials of the Reading and the Lackawanna Railroad Systems Give Some Details of Coming Enterprises—New York Central Prediction

FURTHER information concerning the electrification plans of two important railroad systems—the Reading and the Lackawanna—has been officially made public in the last ten or twelve days. Taken with the Pennsylvania Railroad's announcement, summarized in the ELECTRICAL WORLD for Nov. 3 (page 904) and with the probability that the New York Central system is to follow suit, these statements show that a great step forward in railroad electrification in Eastern territory will soon be taken.

Coming electrification of the major portion of the Reading Railroad in the metropolitan area of Philadelphia, with probable ultimate extensions to New York, Bethlehem and through the Schuylkill Valley territory, was announced by Agnew T. Dice, president of the Reading Company. The directors have given final approval to plans of the railroad management for immediate expenditure of $20,000,000 for electrification of the lines from the Reading Terminal in Philadelphia to Lansdale, from Glenside to Hatboro, from Jenkintown to Langhorne and of the Chestnut Hill branch. The route distance is 49.9 miles with 110 miles of track. Three years will be needed to finish the work.

Mr. Dice announced that the electrification program will insure approximately 25 per cent daily increase in service to the towns and cities in the territory, with a saving in time to and from Philadelphia of from 20 to 25 per cent over present steam train schedules. One hundred of the most modern electric multiple-unit coaches will be placed in the service. These coaches will be propelled by their own motors, and trains will be capable of speeds as high as 70 miles per hour.

It has been decided to use single-phase alternating current at 11,000 volts for propulsion of trains. Overhead trolley wires will be installed and the pantograph types of current collector will be used on cars and locomotives. This wiring will require steel bridges at intervals of about 300 ft. throughout the area of electrification. Active progress is now being made on the extensive detailed plans required. The erection of the catenary overhead wiring will be the first physical work undertaken, and it is planned to begin construction at outlying points. The work will then proceed toward the more congested part of the railroad system. The railroad will build a number of substations at various points for the most effective and reliable distribution of power to all parts of the system. Tentative plans are being made to include electrification on the Norristown branch.

LACKAWANNA'S PLANS

The major preliminary problems involved in the electrification of the Lackawanna system in eastern New Jersey are rapidly being settled, according to an announcement issued by the company, and construction is planned to begin early next spring. The type of supporting structures for the catenary system has been determined upon, and a thorough investigation has been made of the various types and relative costs of bridges and designs; the location of all existing wires and cables along the right-of-way has been plotted for most of the zone to be electrified, and the terminal layout at Hoboken is being planned.

NEW YORK CENTRAL PREDICTION

A possibility that power from the proposed ten-million-dollar, 75,000-hp. Genesee River dam at Mount Morris, N. Y., will be used to electrify the New York Central Railroad system has loomed as the aftermath of predictions by Robert M. Searle, president of the Rochester Gas & Electric Corporation. Speaking very recently before the annual dinner of the Genesee Country Association at Perry, Mr. Searle dipped into the future and outlined development plans which, he said, would, when realized, call for a total outlay of $500,000,000. Their magnitude might be gaged, he said, by the fact that he is in possession of plans including such ambitious undertakings as the railroad electrification.

Ontario Premier Denies Secret Pact with "Power Trust"

Something of a flurry in power circles in Ontario has resulted from recent charges by Harry Sifton, prominent in connection with the proposed Georgian Bay Canal project, that the Ontario Hydro-Electric Power Commission has entered into a "secret" power pact with United States interests for the exportation of 1,000,000 hp. of surplus energy. Addressing a meeting in Toronto, Mr. Sifton declared that two years ago the Hydro commission, with Premier Ferguson's approval, secretly entered into an agreement to export power through an ally of the Buffalo General Electric Company. He accused the Ontario government of "working a very sinister game to deliver large parts of this province to the hands of the American power trust or its branches in Canada." The speaker also discussed the activity of American-owned companies in certain Ontario municipalities in competition with the Hydro commission.

Answering these accusations, Premier Ferguson said that, rather than let surplus power go to waste, the commission disposed of it to the United States interests. "They get it for half an hour, or perhaps for half a day," he said, "and they pay us what we ask for it. This fact is publicly known. It has never been a secret." The Premier added that the Ontario Hydro-Electric Power Commission had saved the people of the province $1,000,000 in the fiscal year just closed by the sale of off-peak power.

Purchases and Mergers

Cleveland Southwestern Railway & Light Ready to Sell Power Interests to Reserve Power & Light—South Carolina Companies United

APPLICATION to buy the power and light properties of the Cleveland Southwestern Railway & Light Company was filed with the Ohio Public Utilities Commission in Columbus on Nov. 9 by the Reserve Power & Light Company. The purchase price was given as $2,087,165. The properties in question are in eight Ohio counties—Cuyahoga, Medina, Lorain, Wayne, Richland, Crawford, Ashland and Morrow—and are along the Cleveland Southwestern's right-of-way. The interurban and motor-coach transportation business of that company will not be affected by the purchase, of which the object is to separate the railway and power and light businesses.

The restraining order issued Oct. 20 temporarily preventing the Augusta-Aiken Railway & Electric Company from merging with the Southeastern Power Company and the South Carolina Power Company has been dissolved on the ground that the majority of the stockholders, both common and preferred, had voted for the merger. The court ordered the South Carolina Power Company to file a bond of $2,000,000 to insure payment to the plaintiffs of such amounts as the court may hereafter determine to be the value of their stock. The new South Carolina Power Company will be a consolidation of the old South Carolina Power Company, the Edisto Public Service Company, the Augusta-Aiken Railway & Electric Company and the Georgia-Carolina Power Company.

According to the North Central Electric Association's news bulletin, the Federal Public Service Company of Chicago has purchased the Root River Power Company of Preston, Minn., the Iowa-Minnesota Power Company of Dodge Center, Minn., and the Gunderson Electric Company of Kenyon, Minn. The two companies last named will be combined as the Southeast Minnesota Power Company.

Authority is being sought by the Glen Rock Electric Light & Power Company from the Pennsylvania Public Service Commission to acquire the Stewartstown Electric Light Company, the Fawn Light & Power Company and the Railroad Electric Light & Power Company.

The Highlands Utilities Company, which is controlled by the North Continent Utilities Corporation, a Delaware corporation, recently purchased the power plant of Dwight Chapin, Jr., at Springfield, Colo.

The Jupollo Public Service Company of Cleveland, Ohio, is reported to have acquired the White Coal Power Company's electric plant at Old Fort, N. C., as well as plants at Franklin, Sparta and Blowing Rock, N. C., and Independence, Va.

Interests associated with the Calgary (Alberta) Power Company have taken over the United Electrical & Engineering Company, Bassano, Alberta, which has been supplying electrical energy to several nearby towns. This plant will be maintained as a standby and energy for its customers is now being distributed by the Calgary Power Company from Kananaskis.

Indiana Commission Compares Public and Private Rates

Some municipally owned electric light plants in Indiana are offering consumers lower rates than privately owned plants in cities of comparable size, according to a survey of rates just made public by the Indiana Public Service Commission. In 28 cities, grouped in fourteen pairs of nearly equal size, the municipal rates, as shown in this selected list, are lower in ten instances, even in two and higher in two. Differences run from 1 cent to 5 cents a kilowatt-hour.

In Anderson, a city about the size of Kokomo, the municipal light plant sells energy for residence lighting at 6 cents, for commercial use at 4 cents and for cooking and heating charges 3 cents. Kokomo's private-plant charges are 9, 8 and 5 cents for the same service, the commission reports. Logansport's municipal rates are equal to those of the privately owned company at Lafayette, and the same equality holds true between the Mishawaka municipal and the Michigan City private companies. The municipal rate in Rushville is 2 cents higher than the private rate in Valparaiso. Peru is the other town where higher municipal rates for residence lighting prevail. There 7 cents is the charge for both residence and commercial lighting and 4 cents for cooking. In Whiting, a city of similar size, the rates are 5 cents for residence and 9 cents for commercial service.

Other cities paired in the survey are as follows: Crawfordsville (municipal), residence lighting 7 cents and cooking and heating 3 cents, against Huntington (private), 8, 6 and 6 cents; Frankfort (municipal), 6, 6 and 4 cents, against La Porte (private), 11 and 11; Fort Wayne (municipal), 5, 5 and 3 cents, against South Bend (private), 8 and 8 cents.

Commission Wants Utilities to Pay in Rate Cases

Members of the Indiana Public Service Commission are rapidly perfecting their plan to permit the utilities operating in Indiana to pay the costs for having their town rates reduced—for this virtually is what the commission's latest step amounts to—and the plan will be presented to the Indiana General Assembly, which convenes the first of the year. It is first proposed that the Legislature create a revolving fund of $100,000 to be used in seeking lower rates through appraisals of the companies and obtaining of evidence. The cost of such examination will, it is provided, be paid back into the fund by the utility after the case is ended, according to Howell Ellis, a member of the commission. The money would be accumulated from the fee of 25 cents on each $100 of securities approved by the Public Service Commission.

According to members of that body they are confronted with a veritable flood of requests for utility rate changes, and it is planning to take the lead in seeking lower rates from Indiana utilities by enlarging its staff of engineers and expert accountants. Members of the commission say their present staff has been kept so busy during the last two years taking care of requests on the part of utilities for higher rates that it has had no time to take an organized step to decrease rates. Early in the present year, with money cheaper, many utilities refunded their outstanding securities at lower interest charges. Within the last few months, however, with higher interest prevailing, few requests for security issues have been made.

P. S. Arkwright for Uniform Rates if They Are Fair

That the Georgia Power Company would welcome a uniform electric light and power rate throughout its territory, provided that it left a reasonable margin of profit to the company, was asserted by President Preston S. Arkwright, testifying before the Georgia Public Service Commission at Atlanta on Nov. 8 in connection with an investigation of electric light and power rates now being conducted by the commission. Mr. Arkwright said that the company since its merger with the Southeastern Power Company has taken over many smaller corporations. It is now serving 128 cities and towns either directly or indirectly, and at present there are 22 separate residential rate schedules in effect, ranging from a 9-cent minimum in Atlanta to as high as 13.33 cents in Brunswick.

In many places, Mr. Arkwright said, there are separate rates for cooking or household power, requiring separate wires and equipment. He thought schedules that were more uniform would broaden and increase the use of power in the state. He maintained, however, that residential service contributed only 3.5 per cent on the value of property which would cost $125,000,000 to reproduce.

Power Board Against Royal Gorge Plant

Sustains Colorado Findings—Few Important Applications Now Received—Roanoke River Report in Shape —Western Projects in Majority

IN VIEW of the action taken by the Public Utilities Commission of Colorado the Federal Power Commission has rejected the application of the Colorado Public Service Company, a subsidiary of the Cities Service Company, for a preliminary permit covering a proposed power development in the Royal Gorge of the Arkansas River. A feature of the case was the refusal of the Federal Power Commission to pass upon the application for a preliminary permit until the Colorado Public Utilities Commission had acted. That this yielding to the state commission was appreciated is indicated in the Colorado commission's report. On that point it says:

"The Federal Power Commission, instead of making its own determination as to whether or not the applicant owed any duty to secure any authority from this commission before going further with the application which it had filed in Washington, with all deference, left it to this commission to determine what requirements we might properly make and to make them before allowing the applicant herein to proceed further before it (the Federal Power Commission). The applicant might then have refused to come before this commission and attempted to show the Federal Power Commission that it owed no duty to seek any authority from the state commission at the then stage of its proceedings before the Federal Power Commission. Instead of doing this, it filed its application here, although obviously against its conviction as to the necessity therefor. The position, then, of the applicant in this case has been a rather difficult one because it has followed a course, if not out of deference to, at least in compliance with the wishes of this commission which it did not consider necessary or proper."

Further indication of the uncertainty surrounding the development of the remaining water-power sites is seen in the fact that only five applications reached the Federal Power Commission during the months of September and October. Three of these applications were of minor importance. For the entire period since the enactment of the water-power law the applications have averaged eleven per month.

The Chief of Engineers has reported to the Federal Power Commission on the conflicting applications of the Virginia-Carolina Power Company of Virginia and the Virginia-Carolina Power Company of North Carolina. While the report has not been made public, indications are that it favors the granting of the application of the North Carolina company, which has the more comprehensive of the two projects. The Virginia company desires to develop Roanoke River, near the Virginia-North Carolina state line, up to the Buggs Island project. The North Carolina company desires to develop a larger sector of the river. It is planned to build two dams which will cover the river from the intake of the existing Roanoke Rapids development, including the site of the Virginia company.

The proposed development on Beaufort Inlet, in South Carolina, by the Low-Head Power Company does not come within the jurisdiction of the Federal Power Commission, in the opinion of members of its staff. A corresponding recommendation will be made to the commission. A similar recommendation has been made in the case of E. L. Dowling, who has filed a declaration of

intention covering a project on the Choctawhatchee near Newton, Ala. The site is just above the head of navigation.

The Empire Development Company of San Francisco has applied for a preliminary permit covering a project on the North and South Forks of Kern River on Nine-Mile Creek and on Golden Trout Creek in Tulare County. It is proposed to divert the waters of Golden Trout Creek into the South Fork of Kern River. A dam will be constructed across that stream forming a reservoir with a capacity of 350,000 acre-feet. A tunnel also will connect with Nine-Mile Creek. A second dam across the North Fork just below Kern Lake will form another reservoir. There is to be a diversion on Nine-Mile Creek a short distance above its confluence with the North Fork. Three power houses are planned in which 160,000 hp. will be installed.

Having complied with the terms of preliminary permits, Jones Brothers of Pueblo, Col., have applied to the commission for a license covering their project on North and Middle St. Vrain Creek and Cabin Creek, near Denver. It is proposed to construct three reservoirs, one with a capacity of 5,000 acre-feet, another with 3,968 acre-feet and a third with 1,485 acre-feet. In this way 8,230 hp. of primary power will be developed. It is proposed, however, to install 15,000 kva. at one power house and 12,000 kva. at another. The power is to be used for public utility purposes.

The Inland Power & Light Company of Portland, Ore., has applied for a license covering a transmission line 8 miles long from Kamiah to Kooskia, Idaho.

The commission has issued the license recently authorized for the Porto Rico Power & Light Company. The delay in the acceptance of the terms of the license was due to the situation arising out of the recent hurricane. The project is on the Blanco River and its tributaries, where 7,000 hp. of primary power will be developed.

With the issuance of a preliminary permit the Cascade Power Company is prepared to start work at once on its surveys in connection with its project on Isabel Lake and May Creek, in Washington State, which are partly within the Snoqualmie National Forest.

The Comanche Mining & Reduction Company of Montgomery, Nev., has applied for a preliminary permit covering a project on Montgomery Creek in Mono County, Calif. The application fails to estimate the amount of power to be generated, but states that a head of over 800 ft. is available. The power is to be used in connection with the applicant's mining operations.

The transfers of licenses to the Pacific Gas & Electric Company from companies recently absorbed have been approved by the Federal Power Commission as follows: Western States Gas & Electric Company, a project on the South Fork of American River; Coast Valleys Gas & Electric Company, transmission line; Western States Gas & Electric Company, Canyon Creek plant; El Dorado Power Company, project on the South Fork of the American River. Similar approval has been given transfers to the Inland Power & Light Company of the Enterprise Electric Company's development on the East Fork of the Wallawa River, in Oregon, and of the Grangeville Electric Light & Power Company's on the Clearwater River in Idaho.

The Southern California Edison Company has applied for a license covering a transmission line in Ventura County, Calif. The license covers the Horn Canyon distribution line, which is already constructed but not heretofore covered by license.

Briefer News

CUMBERLAND FALLS HEARING POSTPONED.—The Federal Power Commission has postponed until Dec. 5 the hearing on the application of the Cumberland Falls Hydro-Electric Company for a permit to erect a plant on the Cumberland River in Kentucky. The hearing was first scheduled for Nov. 14.

NEW ORLEANS PUBLIC SERVICE, INC., TO IMPROVE ELECTRICAL DEPARTMENT.—A program involving the expenditure of $2,000,000 in improvements to its various utility services is announced by the New Orleans Public Service, Inc. Of this amount improvements in the electrical department are put at $600,000.

OSCEOLA (MO.) HYDRO-ELECTRIC PLANT AUTHORIZED.—The Missouri Public Service Commission has granted permission to the West Missouri Power Company to construct a concrete dam across the Osage River and a 2,000-hp. hydro-electric plant near Osceola. The greater portion of the dam has already been constructed, but the hydro-electric plant has not.

SHAWINIGAN COMPANY'S NEW GENERATING UNITS.—The Shawinigan Water & Power Company has just brought into production its new (No. 7) 45,000-hp. unit at Shawinigan Falls, Quebec, bringing the rating of its plant there up to 320,000 hp. The entire output was immediately absorbed into the Shawinigan system. Power produced by the company is rapidly approaching the 700,000-hp. mark, and it actually handles more than that amount through resale of purchased power. The new unit was completed within twelve months. Work is proceeding upon unit No. 8, which will be a duplicate of No. 7 and is expected to be producing by March 1. The addition of the output of No. 7 unit brings the total production at the Shawinigan Falls plant alone to 320,000 hp.

COLUMBUS, DELAWARE & MARION ENLARGING SCIOTO PLANT.—Construction of an addition to the Scioto power plant near Marion, Ohio, to cost $400,000, has been started, according to A. F. Van Deinse, president and general manager of the Columbus, Delaware & Marion Electric Company, and will be completed next year. It will house steam equipment capable of developing 6,000 kw.

A 10,000-HP. HYDRO PLANT ON THE JAMES RIVER ANTICIPATED.—Plans are said to have been completed by the Hydro-Electric Corporation of Virginia for the construction of a dam and generating plant on the James River, near Snowden, Va., that will have a capacity of 10,000 hp. Preliminary work has been started, and the plant is to be ready for operation by Sept. 1, 1929. The development is 4½ miles above the Big Island plant of the Bedford Pulp & Paper Company. Officials of the Hydro-Electric Corporation of Virginia at Richmond decline to make any official statement.

POWER COMPANY OPPONENT ELECTED ATTORNEY-GENERAL OF NEBRASKA.—C. A. Sorenson, who has served as campaign manager in Nebraska for Senator George W. Norris and who urged the same legislative methods and remedies to control the power companies as did the latter, though he dissented from the Senator's indorsement of Governor Smith on that issue, was elected Attorney-General of the state, after a bitter fight and with his majority much below the Republican average. An anti-power-company drive is expected to be one of the outcomes of Mr. Sorenson's election.

EVANSVILLE'S NEW GENERATING STATION PROGRESSING RAPIDLY. — Rapid progress is being made in the construction of the new steam-electric generating station in Evansville, Ind., for the Southern Indiana Gas & Electric Com-

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for July 7, page 48.]

International Conference on Bituminous Coal—Carnegie Institute of Technology, Pittsburgh, Nov. 19-24. S. B. Ely, Carnegie Institute, Pittsburgh.

Public Utilities Association of Virginia—Hotel Roanoke, Roanoke, Va., Nov. 21-22. A. B. Tunis, 301 East Grace St., Richmond, Va.

Electrical Credit Association—Central Division, Palmer House, Chicago, Nov. 22-23; F. P. Vose, 1008 Marquette Bldg., Chicago. New York Division, New York, Dec. 17; W. J. Kreger, 261 Broadway, New York.

American Society of Mechanical Engineers—Engineering Societies Bldg., New York, Dec. 3-7. C. W. Rice, 29 West 39th St., New York.

American Society of Agricultural Engineers—Rural Electric Division, Hotel Sherman, Chicago, Dec. 6-7. Raymond Olney, St. Joseph, Mich.

North Central Electric Association—Engineering Section, Minneapolis, Jan. 21-22. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 28-Feb. 1. F. L. Hutchinson, 33 West 39th St., New York.

pany. This station, on the Ohio River, will have an electrical installation consisting of one new 12,500-kw. turbo-generator unit with condenser and auxiliaries and one 7,500-kw. turbine to be taken from the Division Street station of the same company. It will contain two 1,160-hp. cross-drum boilers, stoker-fired, with necessary auxiliaries. An ultimate development of 100,000 kw. is provided for. The new plant will be interconnected with the Division Street plant by three 12,500-volt tie lines through a modern outdoor substation to be constructed next year. The total cost of this plant, which is being built by Stevens & Wood, is estimated at $1,750,000, and it will be in service in August, 1929.

NEW YORK POWER & LIGHT COMPANY'S EXPANSION PROGRAM. — The New York Power & Light Corporation of Albany, N. Y., has been authorized by the New York Public Service Commission to exercise franchises granted by the upstate towns of Fenner, Cazenovia, Nelson, Cuyler, Truxton, Homer, Cortlandville, Virgil and Fabius. Construction of lines and substation equipment, to cost about $838,000, is being undertaken by the company as a result of this permission.

PACIFIC GAS & ELECTRIC HAS NEW SAN FRANCISCO SUBSTATION.—Station N of the Pacific Gas & Electric Company, at Ninth Avenue and Judah Street, in the "Sunset" district of San Francisco, has gone into operation. The station, which cost $200,000, was built to supply energy to an extension of the Municipal Railway. It is automatically operated and is equipped with two rotary converters for converting alternating to direct current at 600 volts for railway use.

LIGHTING ENGINEERS AT LYNN.—As guests of the General Electric Company the Lighting Engineers' Club of New England visited Lynn, Mass., Nov. 7, devoting the day and evening to an inspection of displays, manufacturing processes and installations of street lighting in the Lynn district. The program included addresses by C. A. B. Halvorson, S. C. Rogers, R. B. Hussey, R. A. Reid, T. G. Whyte, J. A. O'Neil, H. J. Flaherty and P. S. Smalley. Airport lighting and floodlighting were discussed, and the members witnessed a night game of Rugby football played under a battery consisting of 72 1,500-watt projectors.

HARVARD ANALYZES SERVICE USE IN ONTARIO. — The Harvard Graduate School of Business Administration, through its department of public utility management, has issued a study of the development of domestic uses of electricity at St. Catharines, Ontario, one of the municipalities served by the Ontario Hydro-Electric Power Commission. The study covers the period from 1914 to 1926 and is designed to show the effect upon consumption of the very low prices at which energy is sold. No attempt is made to determine whether the business is profitable, the object being to furnish a basis of comparison which might be useful to privately owned companies in the United States in determining rates for similar service. Copies may be obtained at $2 each from the school by addressing it at Soldiers' Field Station, Boston.

ELECTRIC UTILITY PLANNED FOR GEORGIA ISLANDS.—A proposal to expand the Sea Island Utilities Company into a public service corporation to serve all residents of St. Simon's Island and Glynn Isle, Ga., provided that the customers will subscribe for stock, has been submitted to the Georgia Public Service Commission. The output of the Sea Island Utilities Company at present is sufficient only for the hotel, cottages and park there, according to Howard Coffin, president of the company.

NATIONAL EDUCATION ASSOCIATION APPOINTS COMMITTEE TO INVESTIGATE PROPAGANDA. — According to an announcement made by the National Education Association at its headquarters in Washington, Dr. Edwin C. Broome, superintendent of Philadelphia schools, has been appointed chairman of a committee of ten to investigate the use in schools of publicity material supplied by propaganda agencies and organizations. This action carries out a resolution passed at the national convention of the association which was held in Minneapolis last July.

REBUILDING THE LITTLE STATIONS DESTROYED BY FLOOD IN VERMONT.—Two small generating stations are being built by the Twin State Gas & Electric Company on the Passumpsic River in Vermont to take the place of two destroyed in the flood of 1927. One of the new hydro plants will be at Pierce's Mills, above St. Johnsbury Center, and the other at the Arlington Dam, in St. Johnsbury. Though their combined capacity will be only 600 kw., they will, the company says, save the 5,000 tons of coal annually that steam generation would require. The Blue Hill hydro-electric plant of the Public Service Corporation of Vermont at Bethel is also to be restored and enlarged from its former rating of 300 kw. to 500 kw.

CENTRAL-STATION POWER SESSION OF A.S.M.E.—The annual meeting of the American Society of Mechanical Engineers has been set for the week of Dec. 3 in New York City. On Thursday morning, Dec. 6, there will be a central-station power session with these papers: "Design of Steam Piping to Care for Expansion," W. H. Shipman (by title only); "Influence of Coal Type on Radiation in Boiler Furnaces," W. J. Wohlenberg and R. L. Anthony; "Methods of Carrying Peak Loads," A. G. Christie. Progress reports on boiler feed-water studies and discussions on hydraulics, fluid meters and handling of materials will be other features of the convention of more or less interest to electrical engineers and operators. John C. Somers will on Tuesday afternoon discuss "Material-Handling Problems in the Public Utility," with specific reference to the central station.

DANVILLE, VA., CONSIDERS SETTING UP COMMISSION TO RUN CITY UTILITY PLANTS.—Danville, Va., which clings to its municipal plants—electric, gas and water—is considering their removal as an integral part of city government by establishing a commission which would operate the utilities on the same basis as that on which private operation is founded. The Council, however, would control the governing policies and reports would be made to it every thirty days. Slightly reduced rates are also under consideration. Electrical energy will, if these are adopted, be billed at 7 cents a kilowatt-hour. Industrial users of more than 100,000 kw.-hr. a year are to pay 1.025 cents with a 10 per cent discount if monthly bills are paid within five days.

RADIO TO BE USED IN FLORIDA AS AID TO POWER COMPANIES IN TIME OF HURRICANE.—The Florida Power & Light Company is reported to be planning a system of emergency radio communication between the principal cities of Florida to be used only when the regular commercial lines are put out of business by hurricanes or other disasters. The system would consist of low-wavelength sending and receiving stations installed in the cities where the company has plants. The company first plans to get the indorsement of prominent citizens and organizations to serve as a background of general approval to lay before the Federal Radio Commission when it makes application for a license to install and operate the stations.

LOGANSPORT, IND., DEFIES COMMISSION.—The city of Logansport, Ind., will ignore an order from the Indiana Public Service Commission to put into effect electric rates ordered more than two years ago by the commission. This announcement was made Nov. 9 by Mayor Frank Guthrie. The edict from the commission would require adoption of a different scale of rates from that in use, pending decision of two injunction suits now in the Indiana Supreme Court. The city enjoined the commission from interfering with the rates, the suits having been filed when the change now ordered originally was suggested. Excess profits from the plant in the last four years have among other things been applied to a street-lighting system costing more than $100,000, a new city hall costing about $259,000 and street paving to the extent of nearly $100,000.

PROGRESS OF PENNSYLVANIA WATER & POWER'S NEW SUSQUEHANNA RIVER PROJECT.—Although the increased river flow of the Susquehanna River is reported to have interfered somewhat with the investigations which are being carried on in the bed of the river preliminary to starting work on the thirty-million-dollar hydro-electric development

at Safe Harbor, Pa., designs for the Pennsylvania Water & Power project are being pushed along. It is believed probable that the electrification project of the Pennsylvania Railroad between New York and Washington will provide an additional outlet for the power to be generated at the new plant, which is to be built 9 miles up stream from the present dam of the Pennsylvania Water & Power Company at Holtwood. Announcement was made last year of the formation of the Safe Harbor Water & Power Corporation and the Chanceford Water & Power Corporation as subsidiaries of the Pennsylvania Water & Power in connection with the new development. The Safe Harbor project calls for a 200,000-hp. hydro-electric plant with an ultimate capacity of 350,000 hp.

PRESIDENT LEONARD DEFENDS PUGET SOUND COMPANY'S WORK IN SCHOOLS.—A hundred thousand copies of the monograph whose circulation in public schools of the State of Washington recently aroused much protest there have now been distributed by the Puget Sound Power & Light Company among taxpayers of the state, according to a statement issued by the company's president, A. W. Leonard. Mr. Leonard declares that the company, in support of the work of the Washington Industries Education Bureau, and like many other of the leading industries of the state, prepared a monograph describing the operation of its particular business. At the request of the educational authorities, he says, these were furnished for use in the normal and high schools to familiarize students with the resources of the state, and the company found itself "unjustly criticised and accused by certain municipal ownership advocates of putting propaganda against municipal ownership in the schools." He declares that the monograph contained no arguments whatever against municipal ownership, but "was instructive and provided future taxpayers with a general view of an industry that is necessary to their needs and comfort."

Commission Rulings

SUBSCRIBER REFUSED SERVICE BY UTILITY HAS RIGHT TO SEEK IT FROM COMPETING COMPANY.—An Idaho subscriber was refused service by the telephone line in his territory because he also subscribed to a farmers' mutual company. He obtained permission from the Idaho Public Utilities Commission to take service from the Mountain States Telephone Company, the commission saying: "In case a public utility operating in a territory refuses to furnish needed service when said service has been and can be furnished at reasonable cost, this commission can but permit another utility able and willing to furnish such service to enter and furnish the same. A public utility is not justified in withdrawing from a field or any part thereof when an independent company, not a public utility, enters such field."

RURAL RATE BASED ON NUMBER OF CUSTOMERS PER MILE.—A system of charging for rural electric service based on the number of customers per transmission-line mile has been approved by the New York Public Service Commission for electric service supplied by the Lockport Light, Heat & Power Company. A new regulation, effective Nov. 24, provides that all rural extensions will be made on a guaranteed monthly income of $24 per mile of line, prorated on the following basis: Eight customers per mile, $3 each; seven customers per mile, $3.43 each; six customers, $4; five customers, $4.80; four customers, $6; three customers, $8; two customers, $12, and one customer per mile, $24.

NO OBLIGATION TO PROTECT DEFICIENT UTILITY.—Declaring that it will not, except under the most unusual circumstances, permit an existing public utility which has not done its duty to the public to keep its field to itself by agreeing too late that it will henceforth improve its service or lower its rates, or in any other respect comply with its full duty to the public, the California Railroad Commission granted an application from the Truckee River Power Company for permission to extend its electric service into the town of Truckee despite protests from the Truckee Electric Light & Power Company. It is not incumbent upon the commission to determine whether or not a utility district has complied with all requirements of law in the organizations of such districts, the opinion held.

APPLIANCE SOCKETS AND THE LOAD COUNT.—During an investigation of the Wisconsin Railroad Commission into the rates, rules and practices of the Madison Gas & Electric Company the question of eliminating empty baseboard or floor sockets and the ordinary socket appliances from the connected load count was discussed and an agreement was reached that they should be excluded. The commission observed: "For a great many customers, especially in the residence class, this will reduce the number of kilowatt-hours billed at the rates applicable to primary and secondary blocks of energy and consequently reduce their cost of lighting service. A check of the effect of this change, obtained by analyzing the connected load counts of about two hundred customers selected at random, indicates a reduction in lighting bills due to exclusion of empty sockets and of socket appliances of something over $13,500 per year."

REGULATION AN EQUIVALENT FOR ELIMINATION OF COMPETITION.—Elimination of competition through the merger of utility companies is, in the opinion of the New York Public Service Commission, compensated for by the substitution of regulation. In granting its approval for the consolidation of the Brooklyn Edison Company with the Consolidated Gas Company, it said: "The petition is here opposed on the ground that it will destroy such competition as now exists because of the business practices of the Consolidated group and the Brooklyn Edison Company. There is not, nor can there be, any actual competition. Further, the very purpose of the Public Service Commission law is to substitute regulation for competition. Nor are the dangers of lax management foreseen by the author of the brief of a real or potent character. The experience of the past in respect to the petitioner is sufficient ground for the rejection of this idea. Regulation has in the past, and will in the future, protect the people from the inertia of a monopoly and the evils of competition."

Recent Court Decisions

NO RECOVERY FOR PAYMENTS IN EXCESS OF CONTRACT PRICE LONG ACQUIESCED IN AND PRESUMABLY REASONABLE.—Judgment for the defendant was affirmed by the Supreme Court of Appeals of Virginia in a suit brought by the Blackwood Coal & Coke Company against the Old Dominion Power Company to recover sums paid for electric power in excess of what the plaintiff claimed the defendant was under contract entitled to charge. The court found that the mining company had agreed to pay the higher rate pending determination of a new rate by the State Corporation Commission and that the commission had established rates higher than those in the original contract, which were paid without protest. The plaintiff therefore could not recover payments in excess over those provided for in the old contract, rates of utility companies never being immutable and the presumption being that rates acquiesced in for many years before the institution of a suit were reasonable. (144 S.E. 439.)*

RIGHTS OF RIPARIAN OWNERS AS AGAINST OWNERS OF POWER DAM.—Decision for the plaintiffs in Hammond et al. vs. Antwerp Light & Power Company was rendered by the New York Supreme Court. They complained that their rights as riparian owners were adversely affected by the defendant company's operation of its power dams. The company claimed a prescriptive right to impound and draw down the water as it desired, derived from maintenance of a dam at Alpine for 60 years. The court, however, pointed out that to establish a prescriptive right the "adverse user" must be continuous and held that the draining of the lake to the natural flow several seasons out of twenty years was not such a continuous use as to give the defendant a similar right for all time. The evidence, the court said, established the fact that the quantity of water drawn by the defendant during the period complained of far exceeded that taken during the prescriptive period, and that fact, if no other, gave the plaintiffs just cause for complaint. (230 N.Y.S. 621.)

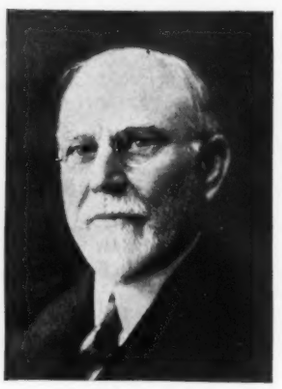
HARDAWAY-DUKE SUIT SETTLED.—Two long-standing suits of the Hardaway Contracting Company of Columbus, Ga., against Duke Power Company subsidiaries, involving more than $3,000,000 in connection with the building of the Bridgewater storage dam on the Catawba River, have been settled in the Superior Court at Charlotte, N. C., by a compromise verdict totaling $385,000 in the two cases. The Hardaway Contracting Company sued the Western Carolina Power Company, a Duke concern, for alleged breach of contract in building the dam. The Wateree Power Company then filed suit in connection with other phases of the construction work. Defendants in both cases filed huge counterclaims. The Western Carolina case was settled for $250,000 and the Wateree case for $135,000. The costs, estimated at $100,000, are to be divided. A referee in the case, which has been in the courts for several years, last year rendered a decision in favor of the Hardaway company after many months of evidence taking. Neither side was satisfied with the referee's decision.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Men of the Industry

Malcolm Muir President of McGraw-Hill—James H. McGraw Still Chairman of the Board

SIGNIFICANT of the growing importance of the service to industry now rendered by the modern "institution of the press" is the announcement just made of the expansion of the executive direction of the McGraw-Hill Publishing Company, publisher of the ELECTRICAL WORLD. The fact that James H. McGraw, founder and president of the company, will continue as chairman of the board, with Malcolm Muir elected to the presidency, is an expression of a development that has been taking place in business journalism. Today there are under this one management twenty-four national magazines serving the engineering professions, ten major industries and the business executive. At the same time the company is also the largest publisher of scientific and technical books in the world.



James H. McGraw

Malcolm Muir

The success of this enterprise has been founded above all else upon a very broad conception of editorial responsibility and leadership, to which Mr. McGraw has tenaciously adhered since the beginning of his journalistic career, forty-three years ago, and which in the beginning was considered entirely too idealistic to be practical. It was the simple principle that the editor's prime obligation is to his industry, a responsibility to provide a functioning "fourth estate" for the service of that professional or industrial community to which his readers belong. It has resulted in the evolution of a high standard of editorial initiative and leadership without which the modern world of business could hardly exist for lack of self-expression and the interchange of experience and news.

Throughout his twenty-three years of active association with Mr. McGraw, Mr. Muir has been a forceful champion of these editorial ideals, and he has in turn made a notable contribution to the improvement of the marketing philosophy of industry. As vice-president of the McGraw-Hill Publishing Company and during his recent term as president of the Associated Business Papers, Inc., he has inspired and aided in the direction of the movement within industry to apply engineering principles to market study as a more efficient substitute for rule-of-thumb and old-fashioned hit-or-miss advertising and selling. During his administration as president of the Associated Business Papers, Inc., marked progress was achieved in elevating the general standards of business publishing.

Mr. Muir therefore assumes the presidency of the McGraw-Hill institution with a splendid background of practical experience and executive responsibility, for he has not only worked his way up through the organization from the bottom but has taken a leading part in the actual expansion of the company. He has had an important influence in the development of the vital spirit of the organization and of its service to its half million subscribers and the forty-five hundred industrial advertisers who reach the marketplace through McGraw-Hill publications.

In the broadened scope of the company's activities, with its correspondingly greater responsibilities and opportunities for service, this division of the top burden of executive direction brings new strength to the organization and promise of an increased capacity for service to industry. Mr. McGraw will continue no less actively in the work, but will be enabled to devote himself more freely to the inspiration and guidance of the editorial leadership of these many publications to which he has given such absorbing interest for so many years.

Mr. Muir's proven sympathy and enthusiasm for the principles for which the McGraw-Hill papers have stood so consistently for so long is a complete assurance of their continuance as the basic policy of this house. It is a guarantee that the same progressive influence which McGraw-Hill has brought to the support of business journalism can be expected to go forward unflaggingly in its constructive service to the upbuilding of American industry.

GEN. JAMES G. HARBORD returned to his desk last week as president of the Radio Corporation of America, following a leave of absence granted for the period of the Presidential campaign, in which General Harbord was chairman of the committee to raise funds for the Republican campaign in the metropolitan area. A number of visitors greeted the General on his return to duty and congratulated him on his campaign work.

C. R. BEARDSLEY, electrical construction engineer with the Brooklyn Edison Company, has been appointed chairman of the accident prevention committee of the National Electric Light Association. Following graduation from the Sheffield Scientific School of Yale University, Mr. Beardsley spent six years with the General Electric Company, first in the test department, later in the power and wiring engineering department and subsequently in the New York office. In 1911 he entered the employ of the United Illuminating Company at Bridgeport, Conn., but severed that connection in 1918 to join the staff of Fred T. Ley & Company, Inc., Springfield, Mass. It was in 1923 that he assumed his present duties with the Brooklyn Edison Company. During his entire career Mr. Beardsley has been engaged in some phase of electrical engineering or construction work in industrial and power plants.

MATTHEW S. SLOAN was elected president of the Yonkers Electric Light & Power Company at a meeting of the board of directors held this week. This makes five companies supplying electric light and power in the Greater New York area of which Mr. Sloan is the chief executive, the others being the New York Edison Company, the Brooklyn Edison Company, the United Electric Light & Power Company and the New York & Queens Electric Light & Power Company. They are being operated as a system with unified management.

HON. ALBERT J. STEARNS has been nominated chairman of the Maine Public Utilities Commission by Governor Brewster, to succeed the Hon. C. E. Gurney, in view of the expiration of

the latter's term, who is not a candidate for reappointment. The term of office is seven years. Mr. Stearns was born at Lovell, Me., 55 years ago and was educated at Boston University Law School. He was admitted to the bar in 1897, served in the Maine House of Representatives in 1907, in the Senate in 1911 and 1913, and was a member of the Executive Council in 1923 and 1925. He was a member of the staff of the late Governor Fernald as judge advocate general and is now a member of the State Board of Public Welfare.

Davidson Heads Nebraska Power Company

James E. Davidson, vice-president and general manager of the Nebraska Power Company, Omaha, since 1917, has been elected president of that company to succeed Walter W. Head, who becomes chairman of the board. No successor to Mr. Davidson will be named as he will continue to serve as general manager. Mr. Davidson has by

J. E. Davidson

no means confined his interest in things electrical to the West, where he has spent the major part of his engineering career, but he has engaged in work of national scope, which led to his election in 1925 to the presidency of the National Electric Light Association, one of the highest honors the industry can bestow.

Starting in the electrical business as a machine oiler, coal heaver and meter reader for a power company at Port Huron, Mich., he was occupying the position of general superintendent of this company when he was twenty years of age. After spending five years in Vermont Mr. Davidson returned to the West, becoming general manager of the Pacific Power & Light Company, this connection marking the beginning of his affiliation with the Electric Bond & Share Company, with which he has been associated ever since. In 1912 he was appointed vice-president and general manager of the Pacific Power & Light Company and remained in this executive position until 1917, when he transferred his interests to Omaha as vice-president and general manager of the Nebraska Power Company.

Mr. Davidson has devoted considerable attention to electrical associations, having served as an officer in branches of the N.E.L.A. wherever he resided. He has been secretary of the Michigan Electric Light Association, president of the Vermont Electrical Association, president of the New England Division, president of the Northwestern Division and president of the Nebraska Section.

C. L. Law Receives New Appointment

Clarence L. Law has been appointed acting general commercial manager of the New York Edison Company, according to an announcement made by Matthew S. Sloan, president. Mr. Law began his career with the company in 1906, as special inspector in the contract and inspection department, and five years later he was appointed manager of the bureau of illuminating engineering in the same department. In 1923 he was made assistant to the general commercial manager and assistant to the vice-president of the Yonkers Electric Light & Power Company, and two years later he was made assistant to the vice-president, commercial relations, of the New York Edison Company. He was serving in these capacities at the time of his new appointment.

Mr. Law is a past-president of the Illuminating Engineering Society, a member of the board of governors of the Electrical Board of Trade of New York and vice-president of the New York Electrical League. He has had a varied experience in the National Electric Light Association as member of the executive committee of the Commercial National Section, chairman of the lighting committee, member of the national public relations committee, chairman of the Metropolitan New York section, member of the public speaking committee of the public relations section and secretary of the insurance committee. Mr. Law has had an active part in the committee work of the Empire State Gas and Electric Association, is treasurer of the Illuminating Engineering Society and an Officier de L'Instruction Publique, Republic of France. In addition he is a member of the A.I.E.E., the American Association for the Advancement of Science and other similar associations.

HENRY B. BRYANS, who was recently elected an assistant general manager of the Philadelphia Electric Company, as announced in the Sept. 29 issue of the ELECTRICAL WORLD, has assumed similar duties for the Philadelphia Suburban-Counties Gas & Electric Company.

W. A. BUTTRICK, president of the Twin State Gas & Electric Company, Boston, Mass., has been elected chairman of the New England Bureau of Public Service Information. D. D. Barnum, president of the Boston Consolidated Gas Company, is vice-chairman, and Joseph B. Groce, head of the public relations bureau of the Edison Electric Illuminating Company of Boston, is treasurer.

McLaughlin Assumes New Duties with Stone & Webster

J. F. McLaughlin, vice-president in charge of operations of the Virginia Electric & Power Company, has been promoted to the position of district manager in charge of the Stone & Webster interests in the Southwestern district, which includes Texas, Louisiana and New Mexico, to succeed Walter H. Burke, who resigned to return to the East. Mr. McLaughlin's position in Richmond will be filled by Thomas P. Walker, vice-president in charge of the Norfolk division.

When Stone & Webster, Inc., assumed executive management of the Virginia Electric & Power Company Mr. McLaughlin removed to Virginia as vice-president in charge of the Norfolk division and was later transferred to Richmond to succeed W. E. Wood as vice-president in charge of operations when Mr. Wood became president.

Joseph Bowes, who has been in charge of the Stone & Webster interests in the

J. F. McLaughlin

El Paso, Tex., district, will remove to Norfolk to succeed Mr. Walker as vice-president of the company. Mr. Bowes has been connected with Stone & Webster for nearly twenty years.

JOSEPH L. SHEA, formerly connected with the electrical department of the Public Service Company of New Hampshire at Nashua, has been named superintendent of the Nashua district.

G. H. BURCHILL has been appointed to the position of assistant professor of electrical engineering at the Nova Scotia Technical College, Halifax, N. S. Mr. Burchill was formerly connected with the Canadian General Electric Company, Ltd., Peterboro, Ont.

LUKE C. BRADLEY of the Electric Bond & Share Company plans soon to spend about three months abroad, principally in South American countries, in an inspection of the utility properties of the American & Foreign Power Company, which is under Electric Bond & Share auspices. The properties controlled include electric light and power plants, electric railways, waterworks and telephone installations.

Financial and Statistical News

Record Trading Again Characterizes Market

THE buying enthusiasm which followed the election, commented upon in the Nov. 10 issue of the ELECTRICAL WORLD, continued during the week under review and utility stocks were no exception to the general rule. Trading was more marked by its volume than by sensational advances, though here and there throughout the list substantial gains were recorded. On the big board utility stocks held firm, but no sensational gains were reported. On the curb certain issues advanced with greater vigor. American Gas & Electric advanced to 186⅞ from a low of 179½ last week. Buffalo, Niagara & Eastern was one of the leaders, moving from 49⅞ to 61½. Puget Sound Power & Light reported a slight advance, as did many of the other light and power issues. In the over-the-counter market industrial stocks were the center of attention.

Central States Electric Expands

Announcement of the offering by American Cities Power & Light Corporation of 400,000 shares of convertible class A stock, optional dividend series (par value $50), and 400,000 shares of class B stock (without par value) draws attention to the rapid and stable growth of the Central States Electric Corporation, which controls the new company through stock ownership.

L. E. Kilmarx, who is president of both companies, says: "The value of the total assets of Central States Electric Corporation has increased during the period from Jan. 1, 1923, to Sept. 30, 1928, from $9,400,000 to $96,100,000, or by an aggregate of approximately $86,700,000. Similarly, the net profits, after all charges and preferred dividends for the year ended Sept. 30, 1928, exceed those for the year ended Dec. 31, 1923, by approximately $5,000,000. The value of the net assets as at Sept. 30, 1928, as shown by the balance sheet of that date, but adjusted to the present market value of securities then owned, after deducting all current and accrued liabilities and funded debt, but before deducting any preferred stock, was over $73,000,000.

The Central States Electric Corporation was organized in 1912 and is engaged in investing primarily in securities of public utility holding and operating companies. Among its investments and those of its subsidiary company are securities of companies which supply electric power or gas service in nine of the fourteen cities in the United States having more than half a million population. It is the largest single stockholder in the North American Company.

American Power & Light Declares Extra Dividend

The regular quarterly dividend of 25 cents cash and a regular semi-annual stock dividend of 1/50 of a share, together with an extra dividend of 5/50 (10 per cent) of a share, on the common stock of American Power & Light Company have been declared for payment Dec. 1 to holders of record Nov. 15. The stock dividends are payable in common stock.

Many Utility Securities Listed

The New York Stock Exchange has authorized the listing of first mortgage gold bonds, series A, 4 per cent of the Cincinnati Gas & Electric Company to the amount of $35,000,000, and also the listing of first lien and refunding mortgage gold bonds of the Philadelphia Electric Company to the same amount. The Boston Stock Exchange has recently authorized the listing of 100,000 shares (par $100) convertible preferred stock, optional dividend series, of the Central States Electric Corporation, with authority to add thereto on notice of issuance and payment in full of 10,000 additional shares. The San Francisco Stock Exchange has authorized the listing of 122,646 additional shares of common stock, no par value, of the Pacific Lighting Corporation. The total now outstanding is 1,250,105 shares. The New York Stock Exchange has authorized the listing of first mortgage 5½ per cent gold bonds of the General Cable Corporation to the amount of $16,000,000 and also the listing of 6 per cent gold debentures of the General Electric Company of Germany to the amount of $15,000,000.

Electric Light and Power Plants in Kansas

The Department of Commerce announces that, according to returns received at the quinquennial census of electrical industries taken in 1928, the total output of electric current in the State of Kansas in 1927, as reported by electric light and power plants, was 825,725,055 kw.-hr., an increase of 74.5 per cent, as compared with 473,070,278 kw.-hr. in 1922. During the same period the generator capacity increased at the rate of 73.8 per cent, from 204,131 kw. to 354,843 kw. Marked increases appear also in the horsepower of steam turbines and internal-combustion engines in use as prime movers, together with considerable but less pronounced decreases for reciprocating steam engines and water turbines.

The 246 electric light and power establishments reported from Kansas for 1927 comprised 30 commercial and 216 municipal establishments. The word "establishment" refers to ownership or control; consequently in many cases a commercial establishment represents two or more generating stations or distributing systems. The corresponding figures for 1922 were as follows: Total, 290; commercial, 75; municipal, 215. The apparent decrease in the number of commercial establishments during the five-year period, representing the net result of a gain of sixteen and a loss of 61, is chiefly a result of the centralization of ownership or control and the absorption of independent generating stations accompanying the extension of transmission lines.

The accompanying table gives a summary for the electric light and power industry in Kansas for 1927 in comparison with 1922. The figures for 1927 are preliminary and subject to revision.

Increased Output in Kansas with Fewer Companies

	1927	1922	Per Cent of Increase or Decrease (—)
Number of establishments, total	246	290	—15.2
Commercial	30	75	(*)
Municipal	216	215	0.5
Prime Movers:			
Total number	438	504	—13.1
Total horsepower	469,792	286,499	64.0
Steam Engines:			
Number	67	129	—48.1
Horsepower	22,408	41,892	—46.5
Steam Turbines:			
Number	88	78	(*)
Horsepower	385,654	193,976	98.8
Internal-Combustion Engines:			
Number	243	263	— 7.6
Horsepower	47,654	31,495	51.3
Water Turbines:			
Number	40	34	(*)
Horsepower	14,076	19,136	—26.4
Generators:			
Number	455	492	— 7.5
Kilowatt capacity	354,843	204,131	73.8
Output of stations, kilowatt-hours	825,725,055	473,070,278	74.5
Number of customers	307,902	236,202	30.4

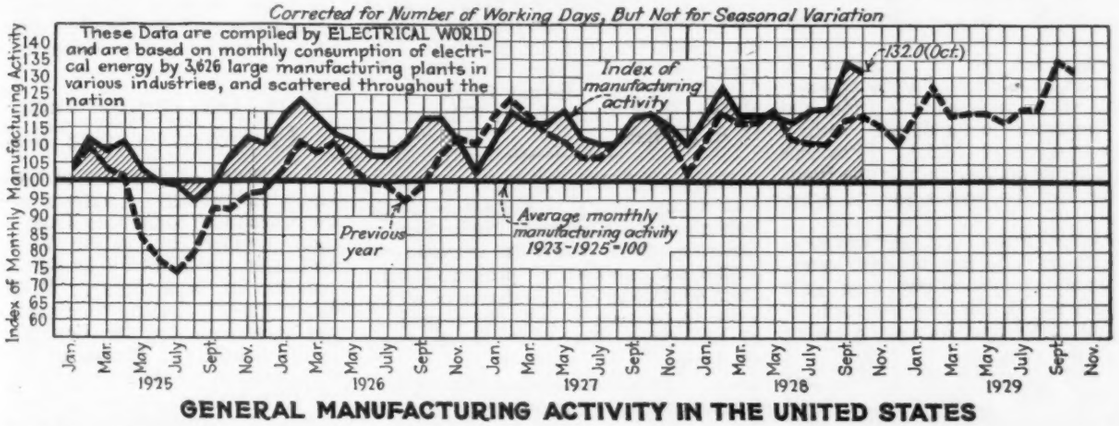
*Per cent not computed where base is less than 100.

High Productive Operations Continue

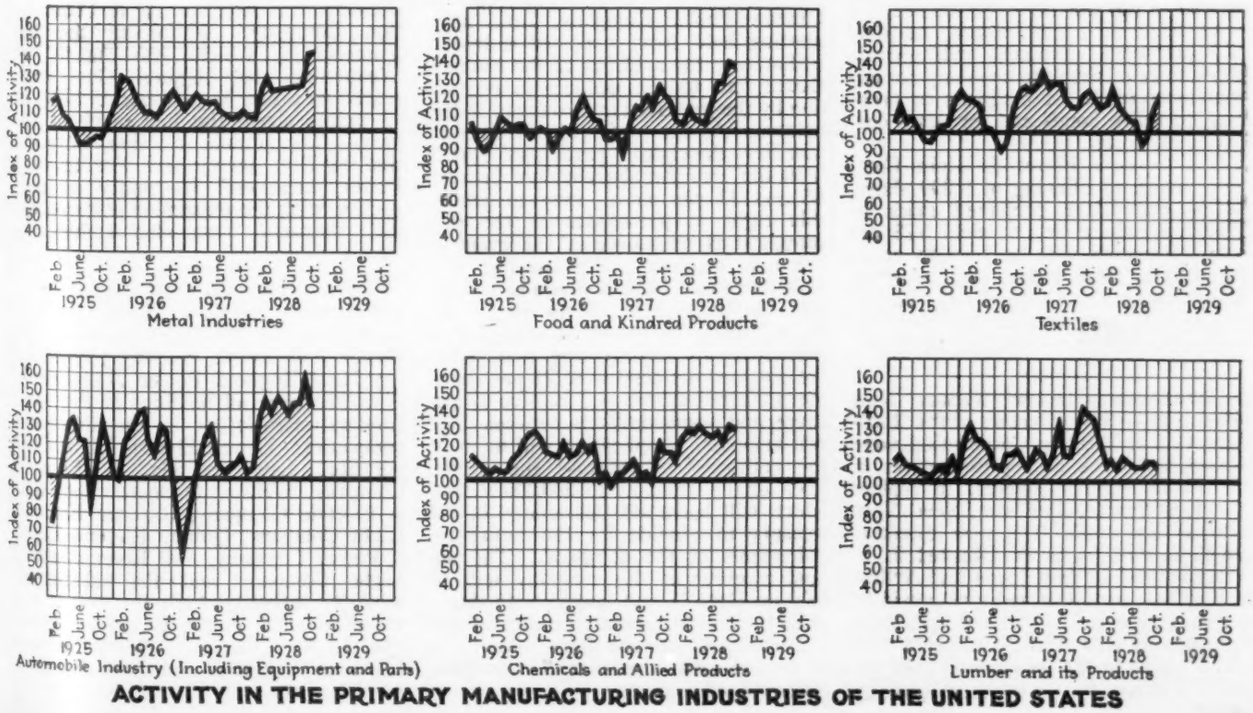
THE second month of the fall season witnessed a rate of general operations in the manufacturing plants of the nation as a whole on an unusually high plane, but on a plane slightly below that witnessed during September. Normally seasonal influences would render such a drop in activity probable. Consumption of electrical energy by more than 3,600 large manufacturing plants as reported to the ELECTRICAL WORLD indicate that the rate of productive operations of general industry during October was about 1.9 per cent under September, but was 10.1 per cent over the rate of operations during October of last year. It appears that the peak of industrial activity for 1928 was recorded in September, and that the remaining months of the year will witness a gradual drop in the rate of activity, though there is every reason to expect that general operations will continue on a comparatively high plane at least until the opening of the spring months.

All of the national primary manufacturing groups with the exception of textiles, leather products, and the lumber and its products group, reported a rate of operations during October over that of last year. Textiles, however, while still operating on a plane some 3.7 per cent under last year, yet has increased its rate of operations during the past three months by 32 per cent. There seems to be every reason to believe that the final two months of the year will find the textile plants operating at a rate over that reported for the same months last year. The automobile industry, including the manufacture of repair and replacement parts, recorded a drop in rate of operations of about 12.2 per cent during October as compared with September, but the industry was still operating on a plane about 23.7 per cent over October last year. On the other hand, the rolling mills and steel plants of the nation recorded a 2.5 per cent increase over September and ferrous and non-ferrous metal working plants a 0.2 per cent increase. With the exception of textiles, iron and steel and metal-working plants all of the industrial groups recorded seasonal drops in activity during October.

The large twelvemonth gains in general manufacturing activity have not been confined to any one section, but have been general throughout the nation, with the exception of the Southern States. Due to the material gains recorded in the textile plants of the section October manufacturing operations in New England were 4.7 per cent over October last year. Manufacturing plants in the Middle Atlantic States were operating at a rate 19.7 per cent above last year, the North Central States recorded a gain of 24.8 per cent and the Western States 18.2 per cent. The textile plants in the Southern States are still operating on a plane some 15 per cent under last year and the lumber industry reported October operations 29 per cent under last year. In general, the manufacturing plants of the South were operating under last year.


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Index of manufacturing activity
132.0(Oct.)
Previous year
Average monthly manufacturing activity 1923-1925=100
Index of Monthly Manufacturing Activity
1925
1926
1927
1928
1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

New Capital Issues

The American Cities Power & Light Corporation, organized to invest and deal primarily in the securities of public utility holding and operating companies, as announced elsewhere in this issue of the ELECTRICAL WORLD, made an offering of 400,000 shares of convertible class A stock, optional dividend series (par $50) and 400,000 shares class B stock, without par value (in the form of certificates of Bankers Trust Company). Certificates representing 10,000 shares of class A stock and an equal number of shares of class B stock have been withdrawn for offering in Holland. The offering was made in units of one share each at $63.50 per unit. Dividends on class A stock of this series are to be payable quarterly in class B stock of the company at the annual rate of one-eighth of a share of class B stock per share of class A stock, or, at the option of the holder, in cash at the annual rate of $3 a share.

First mortgage gold bonds of the Keystone Public Service Company were offered to the amount of $3,600,000, the price being 98.50 and accrued interest, to yield 5.08 per cent. The corporation, organized under the laws of Pennsylvania, upon completion of present financing, will serve with electric light and power seventeen communities with a total population of 51,590. Proceeds will be used to provide in part the funds necessary for the acquisition of properties.

The United Power & Light Corporation made an offering of first mortgage twenty-year five per cent gold bonds, series B, to the amount of $1,000,000 at 97 and interest, yielding over 5.25 per cent.

First and refunding mortgage 5 per cent gold bonds, series B, of the New Orleans Public Service, Inc., were offered to the amount of $5,000,000, the price being 97½ and interest, to yield 5.17 per cent. Proceeds will provide funds to reimburse the company for expenditures made for additions to property, to retire bonds and for other corporate purposes.

The Georgia Power & Light Company made an offering of 9,000 shares of $6 cumulative preferred stock at $95.50 per share flat, to yield 6.28 per cent. Proceeds will be used to retire outstanding funded debt and to reimburse company for expenditures on improvements and betterments and for other corporate purposes.

ROCHESTER UTILITY NAMES NEW DIRECTORS.—New directors of the Rochester Gas & Electric Corporation were named last week as representatives of the E. L. Phillips interest to replace directors representing the New York Central Railroad. The new directors are E. L. Phillips, G. W. Olmsted, R. F. Vandorn and Nathan Jonas and Arthur S. Kleeman, president and vice-president respectively of the Manufacturers' Trust Company of New York, associated with Mr. Phillips in the purchase. They replace Patrick E. Crowley, Albert H. Harris and W. K., W. H. and H. S. Vanderbilt, resigned, all of whom represented the New York Central Railroad. Rochester directors retained were Robert M. Searle, president; Herman Russell, senior vice-president; E. G. Miner, L. M. Todd, Thomas Finucane, Edward Bausch and Daniel M. Beach.

Utility Companies Form New Securities Organization

Formation of the American Cities Power & Light Corporation under the laws of Virginia, with a capitalization of $75,000,000 of class A and 5,000,000 shares of class B stock, has been announced. Officials of the Central States Electric Corporation and the North American Company are the founders and will constitute the board of directors. The purpose of the new corporation is to deal primarily in securities of public utility holding and operating companies. The officers of the company are L. E. Kilmarx, president and treasurer; C. A. Narlian, vice-president; R. E. Glass, vice-president and assistant secretary; W. C. Ross, secretary and assistant treasurer. The directors are H. A. Anderson, F. L. Dame, J. F. Fogarty, H. C. Freeman, Edwin Gruhl, A. C. Sifleet, R. E. Glass, L. E. Kilmarx and C. A. Narlian.

ENGINEERS PUBLIC SERVICE VOTES PREFERRED STOCK INCREASE. — Stockholders of the Engineers Public Service Company have voted to increase the authorized amount of preferred stock from 400,000 to 700,000 shares of no par value in connection with the acquisition of the Puget Sound Power & Light Company.

SOUTHERN CANADA POWER TO SPLIT STOCK.—The directors of the Southern Canada Power Company, Ltd., at a meeting held Nov. 1 passed a by-law authorizing the splitting of the common shares four to one, subject to ratification by the preferred and common shareholders. As the preferred shareholders now have the right to participate equally with the common shareholders between $6 and $7 per share, fully to protect this right to participate in the new set-up, it is proposed, in the event of the new common shares paying over $1.50 per share (which would be equivalent in the present set-up to $6 per share), that the preferred shares shall participate in such a way that, when the common dividend is $1.75 per share, the preferred shares will receive $7 per share, and proportionately between these two amounts. Application will be made for authority to increase the capital stock of the company to 500,000 shares, which will leave 100,000 shares in the treasury to provide for the future requirements of the company. The annual meeting of the company will be held on Dec. 21 and immediately thereafter a special general meeting of the preferred and common share holders will be held to ratify the by-laws embodying the proposed changes.

Montaup Electric Financing

Permission of the Massachusetts Department of Public Utilities to issue 15,000 shares of common stock at $100, par, and $3,000,000 in non-interest bearing notes maturing in five years has been sought by the Montaup Electric Company. The company operates a generating plant near Fall River, Mass., and supplies energy over a transmission system to the Fall River, Blackstone Valley in Rhode Island and Brockton districts. The investment in its property is shared in the following percentages: Fall River Electric Light Company, 37 per cent; Edison company of Brockton, Mass., 14 per cent, and Blackstone Valley Gas & Electric Company, 49 per cent. It is proposed by the Montaup company to finance improvements and extensions of plant amounting to $4,500,000 by issue of 7,395 shares to the Fall River company, 7,425 shares to the Brockton company, 180 shares and the three million dollars in notes to the Blackstone Valley company in return for advances made by these companies to it in connection with the enlargement of the jointly owned plant at Somerset and other improvements.

United Gas Improvement Adds Five to Executive Board

The board of directors of the United Gas Improvement Company enlarged the executive committee from four to nine members by adding Thomas N. McCarter, president Public Service Corporation of New Jersey; William C. Dickerman, operating vice-president of the American Car & Foundry Company; Landon K. Thorne of Bonbright & Company, Donald Stanley of J. P. Morgan & Company and John E. Zimmermann, president of the Day & Zimmermann Engineering & Construction Company. Following the announcement, which was made on Wednesday, the United Gas stock soared to a new high mark of 158¾, or 43 points above the low mark of the year. The Public Service Corporation of New Jersey and Northeastern Power, mentioned frequently in connection with the expansion plans of the gas company, were also active and strong.

DISTRIBUTION COMPANIES NAMED IN FORMATION OF NEW HOLDING COMPANY. — The Massachusetts Light & Power Association, recently formed by the New England Power Association, is to take over all holdings of the New England association in the following companies: Lowell Electric Light Corporation, Lawrence Gas & Electric Company, Webster & Southbridge Gas & Electric Company, Gardner Electric Light Company, Quincy Electric Light & Power Company, Fall River Electric Light Company and the substantial minority interest which the power association holds in the Worcester Electric Light Company, North Boston Lighting Properties and other distribution channels.

Business News and Market Conditions

Electrification Job Will Take 55,000,000 Lb. of Copper

Electrification by the Pennsylvania Railroad of 325 miles of line and 1,300 miles of track, as recently announced by President Atterbury, will call for the use of approximately 55,000,000 lb. of copper, according to an estimate which has just been completed by the Copper and Brass Research Association of America.

This is more than the entire copper production of the United States half a century ago. In 1878 the nation's total output of the metal was about 49,000,000 lb.

The Pennsylvania Railroad's requirements of copper in carrying out its electrification program represent a total greater than the amount of copper in use on the steam locomotives of all American railroads a little more than thirty years ago. The Copper and Brass Research Association estimates the amount of copper in use on steam locomotives in 1896 at about 50,000,000 lb.

Equipment Exports Down in September

Although exports of electrical equipment to all countries in September were 10 per cent below the total for September last year, the total for the year to date was $79,311,174, or 6.8 per cent over the figure for the same period of 1927. Among the items which showed substantial gains this year over last were power transformers, radio receiving sets, refrigeration sets, lighting fixtures, flashlight batteries, etc.

Value and Destination of Electrical Exports for September, 1928, Compared with Corresponding Month in 1927

(Issued by Bureau of Foreign and Domestic Commerce)

Article	September 1927	September 1928
Generators:		
Direct current—		
Under 500 kw.	67,426	50,050
500 kw. and over	82,544	7,424
Alternating current—		
Under 2,000 kva.	10,627	10,076
2,000 kva. and over	84,769	2,500
Steam turbine generator sets	156,328	44,036
Accessories and parts for generators	79,455	54,559
Self-contained lighting outfits	96,055	68,993
Batteries:		
Flashlight batteries	162,317	209,850
Other dry and wet cell primary batteries	161,721	151,282
Storage batteries	273,777	199,949
Transforming or converting apparatus:		
Power transformers	140,568	.....
Power transformers 500 kva. and over	.....	74,223
Distribution transformers, less than 500 kva	.....	73,273
Other transformers	46,554	.....
Instrument transformers	.....	4,313
Other transformers, not elsewhere specified	.....	35,880
Battery chargers under 15 amp	.....	27,047
Rectifiers, double current and motor generators, dynamotors, synchronous and other converters	82,812	27,153
Transmission and distribution apparatus:		
Switchboard panels, except telephone	420,532	35,083
Switches and circuit breakers over 10 amp.	188,096	94,447
Fuses and fuse blocks	36,628	32,903
Watt-hour and other measuring meters	22,269	47,293
Volt, watt, and ampere meters, and other recording, indicating, and testing apparatus	207,174	.....
Electrical indicating instruments	.....	39,758
Electrical recording instruments	.....	8,140
Other electrical testing apparatus	.....	66,416
Lightning arresters, choke coils, reactors, and other protective devices	70,598	33,011
Motors, starters, and controllers:		
Motors under 1 hp.	206,034	.....
Motors ¼ hp. and under	.....	145,830
Motors over ¼ and under 1 hp.	.....	38,479
Stationary motors:		
1 to 200 hp.	201,813	183,140
Over 200 hp.	18,516	28,084
Railway motors	63,213	100,899
Electric locomotives—		
Railway	190,172	13,391
Mining and industrial	37,103	3,085
Station and warehouse electric motor trucks	17,430	5,484
Starting and controlling equipment—		
For industrial motors	82,344	95,062
For electric railway and vehicle motors	67,674	58,020
Portable electric tools	72,971	70,678
Accessories and parts for motors	167,740	130,628
Electric appliances:		
Electric fans	53,028	44,861
Electric lamps—		
Metal filament	91,081	67,025
Other electric lamps	37,635	45,355
Flashlights	155,861	137,244
Searchlights and projectors	20,561	46,506
Motor-driven household devices	198,642	.....
Electric vacuum cleaners	.....	56,051
Other motor-driven devices, except tools	.....	77,673
Domestic heating and cooking devices	127,214	.....
Electric flatirons	.....	21,587
Electric cooking ranges	.....	14,703
Other domestic heating and cooking devices	.....	69,212
Industrial electric furnace and ovens	56,395	24,405
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	148,275	119,296
Signal and communication devices:		
Radio apparatus—		
Transmitting sets and parts	64,768	65,056
Receiving sets	246,239	492,954
Tubes	81,517	62,032
Receiving-set components	197,474	311,003
Receiving-set accessories	247,866	266,203
Telegraph apparatus	153,367	69,562
Telephone apparatus—		
Telephone instruments	27,143	34,926
Telephone switchboards	14,318	26,124
Other telephone equipment	280,191	112,912
Railway signals, switches and attachments	42,221	36,987
Bells, buzzers, annunciators and alarms	23,682	26,591
Other electric apparatus:		
Spark plugs, magnetos, and other ignition apparatus	147,728	.....
Spark plugs	.....	136,364
Other starting, lighting, and ignition equipment	.....	108,226
Insulating material	66,070	67,895
Metal conduit, outlet and switch boxes	74,830	84,195
Sockets, receptacles, and lighting switches	135,228	157,538
Electric lighting fixtures, interior and street	136,301	.....
Electric interior lighting fixtures	.....	145,979
Electric street lighting fixtures	.....	35,294
Other wiring supplies and line material	158,394	64,541
Other electrical apparatus not elsewhere specified	449,459	507,441
Rubber and friction tape	27,249	27,902
Globes and shades for lighting fixtures	43,921	40,141
Electrical glassware except for lighting	19,017	34,333
Electrical porcelain:		
For less than 6,600 volts	45,896	48,916
For 6,600 volts and over	41,778	59,658
Carbons, carbon brushes, and electrodes:		
Electrodes for electric furnaces	149,529	131,449
Other carbon products	116,319	43,973
Insulated wire and cable (iron or steel)	14,789	7,624
Copper, bare wire	111,409	92,337
Copper, insulated wire and cable	361,115	485,327
Refrigeration sets up to 1 ton capacity	284,737	467,513
Domestic washing machines	84,997	156,034
Totals (September)	$8,252,504	$7,401,387
Totals (nine months)	$74,252,891	$79,311,174

DESTINATION OF ELECTRICAL EXPORTS

Country of Destination	September, 1928 Value
EUROPE:	$982,815
Belgium	55,246
France	123,554
Germany	88,547
Italy	110,403
Netherlands	55,530
Spain	89,862
Sweden	30,612
United Kingdom	282,226
Other countries	146,835
WESTERN HEMISPHERE:	$4,853,956
Canada	2,729,561
Mexico	272,960
Cuba	315,794
Argentia	459,856
Brazil	389,417
Chile	168,390
Colombia	152,400
Peru	45,914
Venezuela	71,389
Other countries	248,275
ASIA, AFRICA AND OCEANIA:	$1,564,616
British India	109,464
China	88,313
Japan	318,575
Philippine Islands	96,800
Australia	447,565
New Zealand	122,251
Union of South Africa	108,035
Other countries	273,613

Market Conditions

SEASONAL hesitancy in buying new equipment and materials is reflected in this week's business in the Southeast and Eastern districts. Central stations are tending to limit commitments to immediate requirements and little change in this situation is anticipated before the turn of the year. Farther north, in the New England district, central-station business is more active, but is generally confined to small orders.

The feature of equipment business in the St. Louis district this week is motors and apparatus of all kinds. In the Middle West industrial and railroad demand has increased, while central-station business is well sustained. On the west coast a number of big equipment orders are reported, while routine business is above the average for this area.

Copper and Zinc Steady, with Average Demand

No outstanding activity in the nonferrous metal market occurred in the week ended Wednesday. Though most market followers have considered copper quiet, it has sold in about average volume, with the price unchanged at 16 cents per lb. for Eastern deliveries. Zinc continues in good demand at 6.25 cents, also unchanged.

NEW YORK METAL MARKET PRICES

	Nov. 7, 1928 Cents per Pound	Nov. 14, 1928 Cents per Pound
Copper, electrolytic	16	16
Lead, Am. S. & R. price	6.50	6.35
Antimony	10.25	10.25
Nickel, ingot	35	35
Zinc, spot	6.60	6.60
Tin, Straits	49.75	50
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price Nov. 14, 1928, 17¼ cents.

Quiet Week Reported in Southeast

With the exception of a few large orders reported the generally quiet tone of several weeks past continues in the Southeast. Central-station buying is very conservative and there is little indication that buying in this quarter will pick up materially until the first of the coming year. One of the large power companies ordered creosoted pine poles totaling $7,400 and $5,300 worth of wire and pole line hardware. Another central-station order was for small transformer equipment aggregating $4,600.

Contracts were let covering the construction of a new textile mill in North Carolina and this mill will order motor equipment totaling 3,000 hp. and approximately $40,000 in wiring materials. A contract has been let covering the installation of lighting equipment in a new paper mill in Alabama and lighting fixtures and wiring materials amounting to $15,000 are being ordered for this job. Another contract let covered the installation of a 1,500-kw. turbine which was ordered some weeks ago by an industrial mill in Georgia and $8,000 worth of wiring materials will be required. Another industrial plant located in Georgia has let contracts covering an addition to its plant and will order 1,800 hp. in motors and three 1,250-kva. transformers. Inquiries from textiles are reported as satisfactory. Construction projects are as follows:

The Monongahela-West Penn Public Service Company, Fairmont, W. Va., plans a transmission line from its power plant at Rivesville to Parkersburg, W. Va., about 90 miles, and a power substation at the latter place, to cost $350,000. The Parkersburg Corrugated Box Company, Parkersburg, W. Va., plans a plant expansion to cost $75,000. The Pillsbury Flour Mills Company, Minneapolis, Minn., plans extensions in the plant of the Harvey Paper Company, Wellsburg, W. Va., recently acquired, to cost $200,000. The Louisville & Nashville Railway Company, Louisville, Ky., plans repair shops at Mobile, Ala., to cost $1,000,000. The Georgia Power & Light Company, Valdosta, Ga., plans power substations at Barwick, Boston and Pavo, Ga. Daytona Beach, Fla., will install an ornamental lighting system. St. Petersburg, Fla., plans underground conduit lines and a floodlighting system at the municipal airport, to cost $85,000.

Small Motors Selling in New England

Small motor sales marked the buying in the New England district, one prominent manufacturer recording sales reaching about $48,000 and another reported a group of orders amounting to over $8,000. Fractional-horsepower motors are in demand due to the requirements of machine tool manufacturers. Heavy industrial power equipment demands are quiet, but inquiries are being received and prospects are generally favorable for early sales.

Orders for central-station supplies are steady, but are confined to small lots. The completion of work on new substations and several additions continues to require active movement in wire, outside control apparatus and switches. New construction material is in good demand and fiber conduit, black pipe and cable orders have been in good volume. The general trend in all scheduled material is reported steady and encouraging. Industrial electric furnaces are attracting attention and recently another large newspaper service heating type furnace was ordered. Electric ranges are selling well, while appliance sales show an encouraging gain over last year. Construction projects are as follows:

The Firestone Cotton Company, New Bedford, Mass., plans the installation of new machinery to cost $300,000. The Bay State Thread Company, Springfield, Mass., plans additional equipment for winding and finishing.

Miscellaneous Equipment in Demand in Eastern District

Standard electrical products for miscellaneous central-station and industrial service form the bulk of current business in the Eastern district. There are lagging tendencies in connection with prime movers and other heavy equipment. Central stations are limiting commitments to immediate requirements and it is believed that this condition will prevail until after the turn of the year. A metropolitan utility company has given an order for transformers and switching equipment for substation service to an Eastern maker totaling $150,000 and inquiries continue fair for apparatus of this kind. Automatic regulating equipment shows improvement and inquiries are growing in volume. A Pennsylvania maker has secured a contract from a Western municipal power station for two such units to cost $13,750.

The market for industrial installations shows little change. The demand for motors holds up well and future sales look promising. The automobile industry has become an active purchaser for immediate deliveries; iron and steel mills, also, are making commitments, as well as printing plants and chemical factories. Fractional-horsepower units are in fair call, with talking machine and clock manufacturers prominent buyers at the present time. Control equipment shows marked revival in certain quarters. Paper mills in the eastern part of the country, as well as Canada, are active purchasers and inquiries from this branch of industry are very promising. Recording instruments are developing better sales.

The establishment of municipal airports throughout the country is bringing about an excellent volume of business for rotating beacons and floodlighting systems. Demand for street-lighting equipment shows a firm, steady trend. A Brooklyn hotel has given an order to an Eastern manufacturer for several electric elevators, with operating equipment, aggregating $35,000. Wire and cable business is fair, but trending below the average for this time of year. Construction activities include the following:

The Signal Corps Procurement District, Brooklyn, N. Y., will receive bids until Dec. 4 for 250 volt-ammeters (Circular 38). The Continental Can Company, New York, plans a factory at Los Angeles, Calif., to cost $400,000. The Empire State Ice Company, New York, will build an ice-manufacturing plant to cost $200,000. The Fitzgibbons Boiler Works, Inc., Oswego, N. Y., plans an addition to cost $65,000. The Buffalo, Rochester & Pittsburgh Railroad Company, Rochester, N. Y., plans car repair shops to cost $400,000. The Standard Oil Company of New Jersey, New York, will build a radio broadcasting station at Linden, N. J. The General Baking Company, New York, plans a plant at Baltimore, Md., to cost $200,000. The Radio Corporation of America, New York, has contracted to build a broadcasting station for the Nanking Government, China, to cost $170,000. The State Board of Education, Trenton, N. J., plans a power plant at the proposed normal school at Hillwood Lakes, to cost $100,000.

The Reading Company, Philadelphia, plans the electrification of lines of the Philadelphia & Reading Railway in the metropolitan area, to cost $20,000,000. The Union Dental Instrument Manufacturing Company, Philadelphia, plans a factory to cost $100,000. The Pennsylvania State College, State College, Pa., plans a laboratory building to cost $200,000. The Witherow Steel Corporation, Neville Island, Pittsburgh, plans extensions in its mill to cost $100,000. The Whitaker Paper Company, Pittsburgh, will soon ask bids for a storage and distributing plant to cost $200,000. Baltimore, Md., plans a municipal airport to cost $1,500,000. The Bureau of Supplies and Accounts, Navy Department, Washington, will receive bids until Nov. 27 for lighting and power wire, magnet wire, etc., for the Mare Island navy yard (Schedule 9987), and for two voltage regulators and spares for same yard (Schedule 9989).

Industrial Activity Is Increasing in Middle West

Good business continues in most sections of the Middle West. Industrial activity is becoming more pronounced and the steel industry is in excellent condition, while the automotive industry is continuing its production schedules and a great deal of new equipment is scheduled for purchase by the various railway companies. Reports from the agricultural districts indicate a highly satisfactory condition, while retail and wholesale dry goods concerns report an increase in sales for the first nine months of the year and every indication of continued prosperity. The utility companies are busy with construction work and considerable maintenance work. Apparatus purchasing has been somewhat light, although tentative inquiries for a considerable amount of apparatus are out and several large inquiries in excess of a $1,000,000 worth of cable are pending. Interesting orders placed include eleven 3½-ton electric vehicles consigned to a Chicago utility company, 50,000 lb. of wiping solder and "Mazda" lamps valued at $250,000. Jobbers' sales continue satisfactory. Construction projects are as follows:

The Portage Co-Operative Food Products Company, Portage, Wis., plans a canning plant to cost $100,000. The Wisconsin Power & Light Company, Madison, Wis., contemplates a steam-operated electric power plant at Sheboygan, Wis., to cost $250,000. The Allis-Chalmers Manufacturing Company, West Allis, Wis., plans a mechanical shop addition to its machinery plant, to cost $300,000. The Detroit Edison Company, Detroit, plans a power substation on Rivard Avenue, to cost $35,000. The Murray Corporation, Detroit, plans an addition to its automobile body plant to cost $150,000. The Hayes Body Corporation, Grand Rapids, Mich., plans an addition to its automobile body plant to cost $100,000. The Lackey Foundry & Machine Company, Muskegon, Mich., will make expansions and improvements to cost $450,000. The Sunbeam Aircraft Company, St. Louis, will build an airplane manufacturing plant at Cahokia, Ill., to cost $150,000. The Storkline Furniture Corporation, Chicago, plans a factory addition to cost $180,000. DeKalb, Ill., plans a municipal electric lighting plant. The Illinois Steel Company, South Chicago, Ill., plans a power plant at its steel mill to cost $175,000. The Standard Casket Hardware Company, Greensburg, Ind., contemplates a factory addition to cost $50,000. The Indiana Soldiers' and Sailors' Orphans' Home, Knightstown, Ind., plans an addition to its power plant at the institution to cost $200,000. The Northern Indiana Public Service Company, Hammond, Ind., plans a steam-operated electric generating plant at Michigan City, Ind., to cost $5,000,000. The Indiana Village of Epileptics, New Castle, Ind., plans a power plant to cost $50,000. The Midland Steel Products Company, Cincinnati, Ohio, plans an addition to cost $100,000. The State Department of Public Welfare, Columbus, Ohio, will soon take bids for a cold storage and refrigerating plant at the State Hospital at Cleveland, to cost $100,000. The Ohio Power Company, Newark, Ohio, plans a substation at Fostoria, Ohio, to cost $30,000. Breckenridge, Minn., plans an ornamental lighting system. The Board of Ramsey County Commissioners, St. Paul, Minn., plans a street lighting system to cost $15,000. The Everhart Rubber Company, Grand Island, Neb., plans a factory to cost $80,000.

Equipment Sales Active on Pacific Coast

The week's outstanding order covers two Pelton vertical reaction turbines, each 9,200 hp., valued at $60,000. Railroad orders include one carload of pole line hardware and guy anchors. An oil company bought 1,500 large metal reflectors totaling $8,000, with fittings, for service station billboards and another oil company is purchasing similar equipment. Power company orders include one carload of weatherproof copper wire, sizes 6 to 400,000 circ.mil, for Glendale and 150,000 ft. of ⅜-in. guy strand for Oakland. The government is in the market for 4,000 lb. of solder, 12,000 dry batteries and 30,000 flashlight batteries for coast distribution and ventilating equipment for the San Diego naval hospital. Varied orders of interest include $1,500 worth of plugs for outdoor Christmas tree lighting, a 50-mile forest service line for the Eureka district, $1,500 worth of register tape for the city of San Francisco and street lighting awards of approximately $13,000 each for Alameda and Madera. Proposed construction includes a $2,000,000 California clubhouse for Los Angeles and a junior college for Orange County.

Motor and apparatus sales in the Seattle and Puget Sound district, were reported decreasing, with no indications of heavier volume until after the new year. Sales reported include a switchboard for a Seattle department store, costing between $15,000 and $20,000; 300 bathroom wall heaters, involved in three orders, for apartment house installation; three 250-kva. transformers for a Tacoma saw mill; ten motors, from 40 hp. down, for the Pierce county saw mill; one 100-hp. motor to a Seattle ice plant; a 50- and a 25-hp. motor to a Seattle brick plant and a considerable number of smaller type motors for miscellaneous industrials. The Venus Silver Mines Company, Stevens County, plans a $150,000 power plant, developing 5,000 hp., and the Washington Pulp & Paper Company, Port Angeles, plans a chipping mill and power plant at Neah Bay, Wash. Construction projects are as follows:

The Boiler, Tank & Pipe Company, East Oakland, Calif., will build a boiler and plate shop to cost $70,000. The Pacific Electric Railway Company, Los Angeles, will make extensions in the power substation on Santa Monica Boulevard. The Parr-Richmond Terminal Corporation, Richmond, Calif., plans a storage warehouse and terminal distributing plant to cost $1,000,000. The K. & M. Pottery Company, Los Angeles, plans a plant at Southgate, to cost $100,000. The United Concrete Pipe & Tile Company, Los Angeles, plans a plant at Torrance, Calif., to cost $100,000. Corvallis, Ore., will soon ask bids for an ornamental lighting system. The Inland Power & Light Company, Portland, Ore., plans a steam-operated electric power plant near Joseph, Ore., to cost $100,000. The Northwestern Electric Company, Portland, Ore., plans a hydro-electric power development on the North Fork of the Lewis River near Longview, Wash., to cost $4,000,000. The Pacific Coast Steel Company, Seattle, Wash., plans a plant, to cost $700,000. Wilsall, Mont., contemplates a municipal hydro-electric plant. Riverside, Santa Barbara, Stockton, Long Beach and Porterville, Calif., Haxton, Colo., and Yuma, Ariz., plan ornamental lighting systems.

Motor Sales Good in St. Louis District

Industrial plant purchasing in the St. Louis district continues in very good volume, but principally in stock sizes of motors for replacements or additions. One contract was closed for a 3,000-kw. turbine unit with condenser to cost $65,000. No other orders worthy of special mention were reported, but all manufacturers say that small orders are coming better than for previous periods. This fall jobbers are doing rushing business in apparatus of all kinds, including high-tension switches, street-lighting equipment, radio and wiring supplies. Construction projects are as follows:

The Standard Steel Works, North Kansas City, Mo., plans two additions to cost $100,000. The Missouri Public Service Company, Pleasant Hill, Mo., will build a 66,000-volt transmission line to Warrensburg, Mo. The Kansas Electric Power Company, Atchison, Kan., contemplates a steam-operated electric power at Leavenworth, Kan., to cost $150,000. Paris, Ark., will ask bids for a turbo-generator and other equipment for a municipal power plant. The West Texas Utilities Company, Abilene, Tex., plans a hydro-electric plant on Lytle Creek to cost $4,000,000. Coleman, Tex., plans extensions in its municipal power plant, to cost $45,000. The Wyatt Metal & Boiler Works, Dallas, Tex., will build a plant at Houston, to cost $100,000. The Central Power & Light Company, San Antonio, Tex., plans extensions in transmission lines in vicinity of Harlingen, Tex. The Missouri, Kansas & Texas Railway Company, St. Louis, will build railroad repair shops at Smithville, Tex., to cost $100,000. The Public Service, Inc., New Orleans, La., plans extensions in light, power and traction properties to cost $1,000,000.

Activities of the Trade

Turbine Equipment for Coolidge Dam Power House

A contract has just been awarded to the Pelton Water Wheel Company by the United States Indian Irrigation Service of the Department of the Interior for two vertical reaction turbines designed for variable head operation, 140 ft. to 220 ft., to develop 9,200 hp. each. The turbines are to be furnished complete with governor, actuators and oil pressure systems. Moody spreading grasp tubes are to be used.

The Coolidge Dam development is one of the outstanding engineering projects of recent years, the dam impounding 1,200,000 acre-feet of water on the Gila River. It is second only in size to the Roosevelt Dam development on the Salt River, both projects being in Arizona.

The Coolidge Dam is the first of the multiple-dome type to be built. Because of this it has excited great interest on the part of nationally known engineers and others who have visited the dam, which is now completed and pronounced a massive piece of engineering and contracting.

Building Completely Arc Welded

The recently completed Upper Carnegie Building in Cleveland has been erected entirely by the arc-welding process. It is stated that this is the first commercial store and office building to be erected by this process. Not a rivet or bolt was used in the steel framework. The use of continuous beams with milled columns permitted a reduction in the size of the beams and in designing the size and weight of the column proportional to the load which each floor carries. The welding was done by the Lincoln Electric Company of Cleveland.

Aluminum Solder Corporation Formed

Announcement has just been made that the Aluminum Solder Corporation of America has been formed for the production of aluminum solder. The company produces "Soldalume," which is a white powder and which solders at 350 deg. to 400 deg. F. It is claimed that a temperature of 800 deg. F. is required to destroy the soldered joint, and it is also claimed that the product does not corrode even in salt-laden moist air.

In addition to the powder the company also produces three types of stick solder, one being a low temperature solder for tinning the broken surfaces of aluminum castings, another slightly higher temperature stick solder for building up broken aluminum castings and filling cracks, etc., and a third high temperature stick for welding or soldering with oxyacetylene flame for great strength. Details in regard to the tests to which the solder has been put will be discussed later.

THE TRUMBULL-VANDERPOEL ELECTRIC MANUFACTURING COMPANY, Bantam, Conn., manufacturer of "T V" safety switches, etc., announces the appointment of L. B. Underwood as sales manager with headquarters at the factory at Bantam, Conn.

Mercury Electric Merges with Rainbow Light

Announcement was made by Turney Gratz, president of the Mercury Electric Sign Company of Louisville, Ky., of a merger of the Louisville company and the Rainbow Light, Inc., of Long Island, N. Y. The merged companies plan a $300,000 manufacturing plant in Louisville and the present plant at 432 East Broadway, Louisville, will be enlarged. Martin J. Dillon, assistant treasurer of the New York concern, will move to Louisville, to become treasurer of the consolidated company, which will operate as the Mercury Rainbow Light, Inc., with head offices in Louisville and with branches at Chattanooga, Tenn., and Dayton, Ohio.

Equipment Producers Advised of Export Opportunities

MUCH valuable assistance is being rendered exporters of electrical equipment by the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce. This division covers electric power plant equipment, telephone and telegraph apparatus, electric lighting fixtures and lamp bulbs, appliances such as washing machines, ironers, toasters, etc., and, in fact, anything connected with the electrical industry, including radio apparatus, both transmitting and receiving.

In addition to preparing valuable data on opportunities in the various countries, the division has from time to time issued valuable data on procedure, for example, "The Glossary of Electrical Terms and Instructions to Exporters." The "Exporters' Index," which is the official mailing list of the American firms interested in exports, has an electrical section of considerable importance covering some 1,200 firms which are desirous of employing the services of the division.

One development of the past year, according to Marshall T. Jones, chief of the division, has been the exchange of monthly export statistics between the United States, on one hand, and Germany and Great Britain on the other. Since these three countries control approximately 90 per cent of the whole trade in electrical goods, such data are exceedingly valuable.

A map is now being prepared by the division which when completed will show the location of practically every power plant in the world, different colors denoting capacities in kilowatts. Furthermore, a map of the United States is now being prepared upon which will be shown the location of factories of electrical and radio companies interested in exporting. The division also provides data on wiring practices abroad, regulations as to the installation of electrical equipment, underwriters' requirements, if any, and varied and sundry information of value to the exporter. This includes foreign tariffs, trade regulations, trade protection, commercial reports on foreign firms, etc.

Since 1922 electrical exports have steadily increased from $58,000,000 to $102,000,000 in 1927. So far this year they are ahead of last year by some $6,000,000.

Anaconda Copper Rebuilds Electrical Cable Plant

The Anaconda Copper Mining Company, through its subsidiary, the American Brass Company of Waterbury, Conn., is rebuilding its electrical cable plant at Hastings-on-Hudson. The plant will be constructed to produce the highest quality power cable of all types. The best insulating machinery and the most approved drying and impregnating apparatus are to be installed. A testing laboratory for the most advanced high-tension cable work and for the examination of insulating oils, paper and cable sheath is being provided.

The development of this high-tension cable plant is in keeping with the progress of the industry and is designed to meet the ever-increasing demand of the public service companies for high quality, high-tension cables. The Hastings plant is one of the largest copper cable mills in the country. The products run annually around 100,000,000 lb. This figure includes other materials as well as copper in the cable output.

British American Tube Mills in Operation

The tube mills of the British American Tube Division of the National Electric Products Corporation which have been under construction on tidewater at Bayway, New Jersey, are now completed and production of "Blackskin" condenser tubes and "Bulldog" brass

pipe has begun. These mills replace those of the British American Metals Company, Inc., at Plainfield, which were destroyed by fire the early part of the year, preventing temporarily the manufacture of the products above mentioned.

The new mills have been designed to handle a capacity about two to three times greater than the mills that were destroyed. The equipment in every respect includes the latest and most modern machinery, all of which is electrically operated and supervised by the highest type of skilled mechanics who have become specialists in manufacturing condenser tubes and brass pipe. These mills are now operating.

Neon Corporation Establishes Headquarters in Memphis

The Scientific Neon Corporation, sign makers, with operating plants throughout the United States, has chosen Memphis, Tenn., as headquarters for the development of the new industry in the Southeast. Approximately 100 Neon sign plants will be installed during the coming year from the Memphis office. E. J. Welch, Los Angeles, and C. W. Adams, San Francisco, executives of the corporation, are in charge of operations in this territory. The company will operate on a leasing basis, offering merchants Neon lighting and sign display advertising on a rental basis.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY announces that the Tata Iron & Steel Company, Jamshedpur, India, recently purchased a 4,600-hp., 0-50-120-r.p.m. reversing mill motor. A flywheel set accompanying the motor provides the necessary power and consists of two 1,900-kw. generators, one 75,000-lb. flywheel and one 3,500-hp. induction motor, all operating on the same shaft at a speed of 500 r.p.m. A liquid slip regulator controls the load on the flywheel set. The motor will be used in a 36-in. roughing mill, for rolling rail and structural shapes. The roughing mill was built by the Brightsides Foundry Company, England. Perin and Marshall, New York City, were the consulting engineers for the company in America.

THE UNITED ELECTRICAL MANUFACTURING COMPANY, Adrian, Mich., manufacturer of electrical devices, has appointed the Manufacturers Distributing Company, 40 Worth Street, New York City, as distributor of the Eskimo brand of electric fans, kitchen mechanics, hair driers, ventilators, etc. The territory it will cover will include New York state, the Metropolitan district of New York, New Jersey and the New England states.

THE INTERNATIONAL COMBUSTION ENGINEERING CORPORATION, 200 Madison Avenue, New York City, through its subsidiary, the Combustion Engineering Corporation, has received a contract from the Philip Carey Manufacturing Company of Cincinnati for two steam generators to operate at 1,800 lb. steam pressure. The plant, at Lockland, Ohio, will be the largest high-pressure steam plant in the world. All the equipment for the plant will be ordered from American manufacturers except the main engines, which will be furnished by A. Borsig of Berlin, Germany.

THE GENERAL ELECTRIC SUPPLY CORPORATION, New York, wholesaler, has purchased the business of the Mountain Electric Company of Denver, Colo., and will continue a strictly wholesale business but with a vastly enlarged program made possible by the resources, vision and facilities of the General Electric Company.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY announces the appointment of H. H. Ashinger as assistant to the general manager and manager of engineering for the South Bend works of the company. Mr. Ashinger was for thirteen years in the employ of the George Cutter Company, which was taken over by the Westinghouse company.

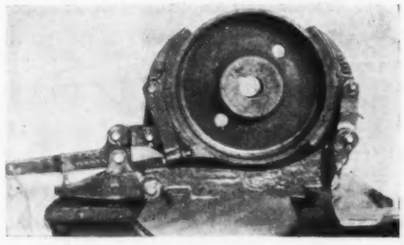
THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, manufacturer of electric instruments and circuit breakers, has appointed Arthur H. Abbott, Inc., 88 Broad Street, Boston, as its New England representative.

THE FULTON IRON WORKS, St. Louis, manufacturer of Diesel and steam engines, etc., announces the appointment of F. Edward O'Neil as vice-president and manager of its Diesel division, with headquarters at St. Louis. Mr. O'Neil has been with the company since 1905 and for the past eleven years he has been in charge of the company's New York office.

New Equipment Available

A Brake for Lever Operation

A new brake arranged for lever operation is being built by the Electric Controller & Manufacturing Company, Cleveland, Ohio. It is of the shoe type and is intended for the bridge drives of electric traveling cranes, lift bridges, electric hoists and other applications requiring foot-operated or hand-lever-



operated brakes. The new brake is a modification of a previous electrically operated type and nearly all of the wearing parts are interchangeable with parts of the old type. It is stated that the tendency toward the use of anti-friction bearings on cranes and other machinery has resulted in an increased amount of work for this type of brake.

Varying-Rate Charging Panel

A new varying-rate charging panel has been developed by Hobart Brothers, Troy, Ohio, designed to be combined to form complete installations in any capacity, limited only by the capacity of the constant potential battery charger with which they are used. These panels may be used on any battery bench or may be mounted directly on the wall of the shop. The rheostats are so designed that turning the hand wheel to the extreme left position entirely disconnects the battery from busbar current. The extreme right position connects the battery to the rapid charging constant potential line. Between these two positions are fifteen others, giving fifteen different charging rates—stepping up gradually from left to right. By using the rheostats and referring to the meters, each battery may thus be given any special treatment.

Capstan Type Car Puller

A Junior model vertical capstan type car puller has recently been brought out by the Stephens-Adamson Manufacturing Company of Aurora, Ill.

The motor frame is bracket-mounted to a steel plate which is riveted to the channels to form part of the base. The bevel reduction gears are inclosed in the machine housing, which affords them excellent protection from abrasive substances. One man easily operates the machine. The capstan has a speed of 15 r.p.m. and exerts a 2,000-lb. rope pull. It is driven by a Westinghouse 5-hp. motor. The weight of the complete equipment is only 1,075 lb.

MOTOR-DRIVEN SIGNAL.—A new motor-driven signal for which is claimed unusual carrying and penetrating power has been developed by the Benjamin Electric Manufacturing Company of Chicago. The motor attains full speed almost instantly when contact is made and does not coast after the current is cut off.

ADJUSTABLE STEP-DOWN TRANSFORMER.—A new adjustable step-down transformer has been placed on the market by the Radiart Laboratories, Inc., Cleveland, which permits of adapting the radio receiver to any house voltage. The new feature of this transformer is that it is equipped with a special four-point switch which is connected to the tapped primary winding.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 30, 1928)

1,689,432. ELECTRIC HEATER SYSTEM; W. G. Hartwig, Chicago, Ill. App. filed April 9, 1923.

1,689,442. SOLENOID BRAKE; G. J. Lexa, Wauwatosa, Wis. App. filed April 14, 1926.

1,689,483. STORAGE-BATTERY CHARGING SYSTEM; W. S. H. Hamilton, Schenectady, N. Y. App. filed Feb. 25, 1925.

1,689,485. CURRENT-SUPPLY SYSTEM; W. F. Hendry, Ossining, N. Y. App. filed May 12, 1927.

1,689,493. POWER SYSTEM; C. MacMillan, Schenectady, N. Y. App. filed June 3, 1925.

1,689,495. ELECTRIC SWITCH; F. McElroy, Manchester, England. App. filed Aug. 9, 1926.

1,689,499. DYNAMO-ELECTRIC-MACHINE ROTOR; H. G. Reist, Schenectady, N. Y. App. filed Feb. 17, 1927.

1,689,502. RECTIFYING SYSTEM; C. A. Sabbah, Schenectady, N. Y. App. filed Feb. 9, 1927.

1,689,503. STATOR CONSTRUCTION; M. A. Savage, Scotia, N. Y. App. filed June 20, 1927.

1,689,508. PROTECTIVE DEVICE; O. C. Traver, Schenectady, N. Y. App. filed July 14, 1924.

1,689,511. SWITCH PLUG; W. J. Wise and T. O. Adams, New Philadelphia, Pa. App. filed Jan. 19, 1922.

1,689,515. AUTOMATIC RECLOSING-CIRCUIT-BREAKER SYSTEM; A. E. Anderson, Scotia, N. Y. App. filed Feb. 26, 1926.

1,689,516. REMOTE-CONTROL SYSTEM; E. F. Bliss, Schenectady, N. Y. App. filed May 9, 1924.

1,689,518. RECTIFYING SYSTEM; H. D. Brown, Schenectady, N. Y. App. filed Feb. 5, 1927.

1,689,521. WATER HEATER; M. D. Dominguez, New Orleans, La. App. filed Aug. 15, 1927.

1,689,525. ASYNCHRONOUS MOTOR; V. A. Fynn, St. Louis, Mo. App. filed Dec. 18, 1925.

1,689,527. SWITCH; W. A. Reinrich, St. Louis, Mo. App. filed July 27, 1925.

1,689,532. POWER SYSTEM; C. MacMillan, Schenectady, N. Y. App. filed June 18, 1925.

1,689,559. AUTOMATIC STARTING DEVICE FOR ALTERNATE-CURRENT MOTORS; B. Raettig, Hoffnungstahl, near Cologne, Germany. App. filed Feb. 9, 1926.

1,689,577. WELDING ROD; F. M. Becket, N. Y. App. filed March 30, 1926.

1,689,616. ELECTROMAGNETIC CHUCK; J. Bing, Eisenach, Germany. App. filed June 3, 1924.

1,689,632. HANGER FOR TROLLEY WIRES; E. F. Joyce, Wheeling, W. Va. App. filed Sept. 16, 1926.

1,689,655. LIGHT SIGNAL; W. B. Wells, Wilkinsburg, Pa. App. filed March 20, 1925.

1,689,660. METHOD AND ARRANGEMENT FOR COMPARATIVE ALTERNATING-CURRENT MEASUREMENTS; D. Albrecht, Berlin, Germany. App. filed Jan. 29, 1925.

1,689,720. ELECTRIC CIGAR LIGHTER; W. C. Grunow, Chicago, and O. E. Grigsby, Park Ridge, Ill. App. filed June 21, 1924.

1,689,764. AUTOMATIC CONTROLLER; F. J. Bast and R. M. Wilhelm, Brooklyn, N. Y. App. filed Sept. 10, 1925.

1,689,781. LIGHTNING ARRESTER; E. H. Jacobs, Chicago, Ill. App. filed Feb. 4, 1921.

1,689,785. TEMPERATURE-COMPENSATING DEVICE; M. Knight, Holyoke, Mass. App. filed Oct. 29, 1925.

1,689,795. THERMAL-CONTROL SWITCH; A. J. Mottlau, Pittsburgh, Pa. App. filed Oct. 15, 1926.

1,689,801. VALVE TAPPET; A. W. Pope, Jr., Waukesha, Wis. App. filed March 12, 1925.

1,689,809. THERMOSTATIC DEVICE; V. G. Vaughan, Mansfield, Ohio. App. filed Sept. 30, 1927.

1,689,819. REMOVABLE CHEMICAL RECTIFIER; J. K. Elderkin, Montclair, N. J. App. filed Nov. 10, 1925.

1,689,820. SOCKET RECEPTACLE; F. F. Forshee, Mansfield, Ohio. App. filed Sept. 9, 1927.

1,689,824. ELECTRICAL CONNECTER; L. A. Goelz, Pittsburgh, Pa. App. filed Sept. 16, 1926.

1,689,830. ALARM GAUGE; O. W. Heise, Bridgeport, Conn. App. filed Aug. 26, 1925.

1,689,833. SIGNAL CLOCK; C. Kesses, New York, N. Y. App. filed Sept. 7, 1921.

1,689,836. CIRCUIT INTERRUPTER; J. W. Legg, Wilkinsburg, Pa. App. filed Dec. 21, 1920.

1,689,840. TRANSFORMER SWITCHING SYSTEM; A. J. A. Peterson, Wilkinsburg, Pa. App. filed April 21, 1923.

1,689,843. MAGNET STRUCTURE; A. R. Rutter, Forest Hills, Pa. App. filed July 6, 1926.

1,689,849. ELECTRICAL MEASURING INSTRUMENT; L. M. Aspinwall, Pittsburgh, Pa. App. filed Aug. 7, 1926.

1,689,850. TERMINAL FOR ELECTRIC HEATING UNITS; C. B. Backer, New York, N. Y. App. filed July 30, 1927.

1,689,851. CIRCUIT BREAKER; A. H. Bakken, Edgewood Park, Pa. App. filed July 9, 1921.

1,689,852. ELECTRICAL SWITCH; H. W. Batcheller, Marion, Ind. App. filed Oct. 9, 1926.

1,689,867. SIGNALING SYSTEM; R. D. Evans, Wilkinsburg, Pa. App. filed May 28, 1924.

1,689,876. APPARATUS FOR ELECTRICALLY HEATING METAL BARS; E. S. Jeffries, Hamilton, Ont., Can. App. filed Dec. 19, 1921.

1,689,877. MARINE PROPULSION; G. A. Juhlin, Sale, and L. Miller, Whitefield, England. App. filed Feb. 26, 1921.

1,689,882. AUTOMATIC WELDING APPARATUS; A. M. MacFarland, Pittsburgh, Pa. App. filed May 18, 1926.

1,689,906. INSULATOR; C. Aalborg, Pittsburgh, Pa. App. filed March 23, 1920.

1,689,915. ELECTRIC HEATING VESSEL; C. Endorf, Chicago, Ill. App. filed Dec. 16, 1925.

1,689,926. ELECTRIC SWITCH; G. J. Meuer, Milwaukee, Wis. App. filed June 15, 1923.

1,689,934. ELECTRIC GENERATOR; G. B. Rolfe, London, England. App. filed April 17, 1923.

1,689,938. LAMP HANGER; A. J. Thompson, Cleveland, Ohio. App. filed Dec. 22, 1922.

1,689,946. ELECTROMAGNETIC RELAY DEVICE; A. E. Hudd, Wallasey, England. App. filed Oct. 31, 1925.

1,689,992. ELECTRICITY METER; W. Beusch, Zug, Switzerland. App. filed Aug. 6, 1923.

1,690,014. LIQUID SWITCH; J. R. Jackson, Jr., Brookline, Mass. App. filed April 25, 1924.

1,690,028. ELECTRIC SWITCH; A. H. Nero, New Britain, Conn. App. filed Feb. 21, 1922.

1,690,052. ELECTRIC SWITCH; J. R. Carlson, Hartford, Conn. App. filed Nov. 7, 1922.

(Issued Nov. 6, 1928)

17,127 (reissue). REMOVABLE STATOR FOR ELECTRIC MOTORS; C. L. Daun and P. E. Keller, Milwaukee, Wis. App. filed Sept. 17, 1927.

1,690,101. SOLDERING TOOL; F. B. Burns, Chicago, Ill. App. filed Oct. 28, 1926.

1,690,103. ELECTRIC SWITCH; E. L. Clark, Pittsburgh, Pa. App. filed June 3, 1924.

1,690,118. BATTERY CONNECTER; F. G. Julyan, Euclid, Ohio. App. filed May 21, 1926.

1,690,142. REGULATING DYNAMOTOR; H. L. Tanner, Brooklyn, N. Y. App. filed July 26, 1927.

1,690,154. TRANSFORMER; M. Alden, Springfield, Mass. App. filed Dec. 14, 1926.

1,690,174. METER MOUNTING; T. J. Newman, Canton, Ohio. App. filed July 26, 1924.

1,690,184. TRANSMISSION-LINE DEVICE; R. M. Stumm, Philadelphia, Pa. App. filed Oct. 20, 1927.

1,690,185. TRANSMISSION-LINE DEVICE; N. J. A. Wahlberg, Wilkinsburg, Pa. App. filed July 30, 1927.

1,690,187. AUTOMATIC STARTER; F. R. Zumbro and F. Shenton, Waynesboro, Pa. App. filed May 18, 1926.

1,690,200. TRANSMISSION-LINE DEVICE; F. H. Miller, Wilkinsburg, Pa. App. filed Oct. 20, 1927.

1,690,220. GROUND CONNECTER; A. P. Fahnestock, Plandome, N. Y. App. filed May 13, 1926.

1,690,246. THREAD-WAXING DEVICE; E. J. Ray, Beverly, Mass. App. filed Dec. 7, 1922.

1,690,264. AUTOMATIC DOOR CLOSING AND LOCKING DEVICE; C. L. Wolfe, Brooklyn, and J. A. Faurot, New York, N. Y. App. filed July 18, 1923.

1,690,273. ELECTRIC FURNACE; F. T. Cope, Salem, Ohio. App. filed Nov. 9, 1925.

New Trade Literature

UNIT HEATERS.—Bulletin No. 7418 issued by the American Blower Corporation, Detroit, describes and illustrates the "Sirocco" unit heaters for floor and ceiling applications, high and low pressure types, for use in factories, warehouses, shops, garages and industrial institution of all types.

BELT DRIVES.—The L. H. Gilmer Company, Tacony, Philadelphia, has issued a handbook of small belt drives which discusses the use of belts of rubber and cord fabric for power transmission, with special reference to the application of V-belts to short center and high-speed drives. The booklet contains engineering data for use in designing V-belt drives and many illustrations are given showing Gilmer belts on a variety of machines.

ELECTRICAL PRECIPITATION.—The Research Corporation, 25 West 43d Street, New York City, is distributing bulletin No. 203 covering electrical precipitation for the recovery of sulphuric acid from exit gases by the Cottrell process.

AIR FILTERS.—A circular issued by the Midwest Air Filters, Inc., Bradford, Pa., covers its model S-H horizontal automatic air filter. A pamphlet describing the installation of Midwest air filters at the Pittsfield Electric Company, Pittsfield, Mass., is included.

AUTOMATIC CONTROL APPARATUS.—Bulletin No. 500 issued by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, describes and illustrates the L&N automatic control for acid baths. Directions for taking care of the equipment and a price list are included.

STATIONARY ELEVATORS.—The Revolvator Company, 336 Garfield Avenue, Jersey City, N. J., has issued bulletin No. 91 F describing and illustrating the Revolvator line of stationary elevators, self-contained and portable.

COLLECTOR RAIL SUPPORTS. — The Delta-Star Electric Company, 2400 Block Fulton Street, Chicago, has issued bulletin No. 31-GA describing a new line of 600-volt collector rail supports for cranes, ore bridges and industrial railroad service. It also contains a table on the ratio of steel rail to copper resistance.

ELECTRICAL PROTECTIVE EQUIPMENT.—The I-T-E Circuit Breaker Company, Nineteenth and Hamilton Streets, Philadelphia, has issued bulletin No. 220 illustrating the new "U-Re-Lite" all-steel distribution groups. This bulletin deals primarily with the group method of mounting "U-Re-Lites" on all-steel frames.

GROUNDING METHODS.—The Borden Electric Company, 480 Broad Street, Newark, N. J., is distributing bulletin No. 70-A, which is a supplement to bulletin No. 70. This bulletin covers the use of solid rod electrodes and lists groundheads for the same, as well as cable and bus connectors and drilling data for types EBS and PSP groundheads. Price lists also are included.

DEVICES FOR ELECTRIC HOISTS AND CRANES.—The Hoist & Crane Engineering Company, 114 Liberty Street, New York City, has issued a set of data sheets describing and illustrating devices for electric hoists and cranes.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Johannesburg, South Africa (No. 34,244), for dry batteries.

An agency is desired in Malmo, Sweden (No. 34,246), for dry and storage batteries.

An agency is desired in Bombay, India (No. 34,237), for flash lights.

An agency is desired in Buenos Aires, Argentina (No. 34,247), for flash lights.

Purchase is desired in Nairobi, Africa (No. 34,339), of lighting apparatus for theater stage.

An agency is desired in San Sebastian, Spain (No. 34,245), for traffic lights.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

That Decreasing Price of Electricity

BY A curious coincidence the number of automobiles in operation, the number of telephones and the number of electric services in the United States do not differ greatly. That is to say, the three figures are all in the general vicinity of 20,000,000. Each of these accessories to modern life is used in part for business, in part for residential or individual purposes. The proportions are probably not the same in each case, but a rough equality still remains between the number of private cars, of homes using the telephone and of residential electric customers.

But in annual expense the first undoubtedly far surpasses the two others, which in turn constitute nearly equal shares in the family's operating expenses. Indeed, in many cases, perhaps in the majority of them, the lighting bill is the lower. In round numbers, the average of each is between $30 and $40.

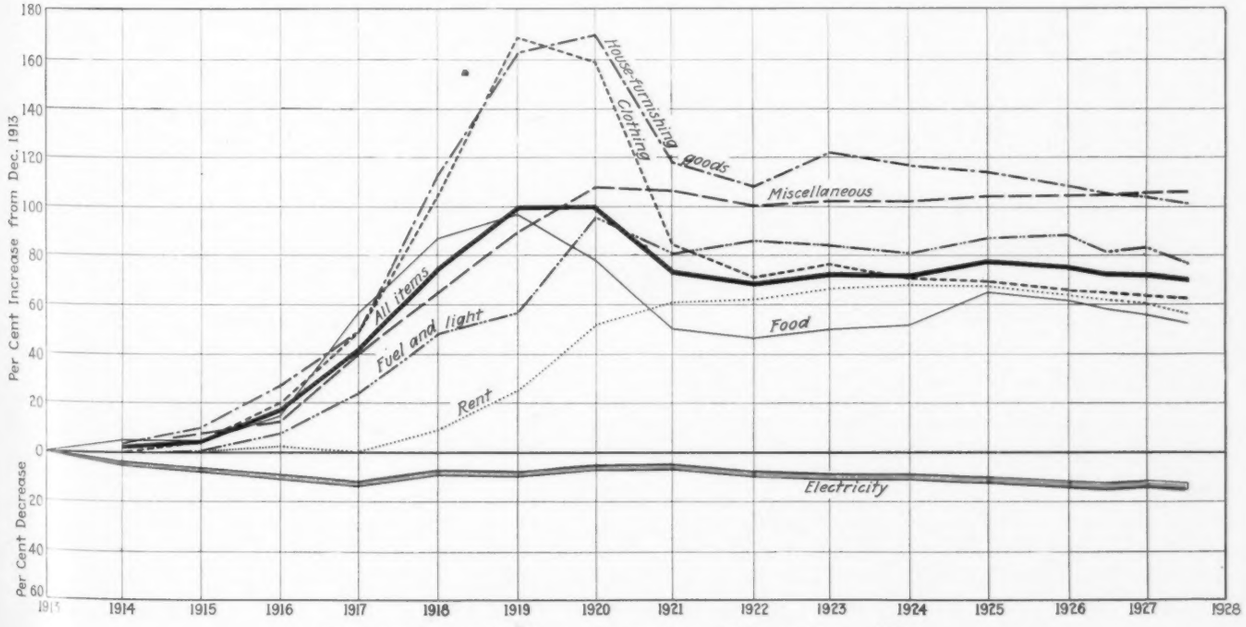
Under the circumstances, slight changes in the residential energy rate ought to be a matter of relatively little interest compared, for instance, with a change of 1 or 2 cents in the price of a quart of milk, which most of us seem to accept with comparative equanimity even when it is upward.

Whatever may be the logic of the situation, it appears to be a fact that residential energy rates are a matter of perennial discussion. It is therefore timely to point out once more, on the basis of statistics given in the Monthly Labor Review of the Bureau of Labor Statistics, for August, 1928, that the average price of electricity continues to fall and in June, 1928, was 13.6 per cent lower than at the end of 1913, whereas the weighted average price of all items entering into the family budget is still 70 per cent higher than it was at the end of the year of reference. The determinations are based on returns regularly received from 32 cities, and the price movements are therefore entirely comparable and may be considered representative of the country as a whole.

The fluctuations of the individual items are shown in the accompanying chart. Food and clothing reached their peaks in 1919, but are still 52.6 and 62.6 per cent above their pre-war level. Rents rose more gradually and have only lately shown signs of a moderate decline. This item stood at plus 57.6 in June. In the class designated as "fuel and light" the former is by far the larger component. It is still 77.2 per cent higher than in 1913. Housefurnishing goods continue to cost more than twice as much as they did fifteen years ago; the same is true of the miscellaneous group. The percentages of these last two above the 1913 base are 101.1 and 105.5 respectively. The weighted average of all items had increased by slightly more than 100 per cent in 1920, but subsequently decreased.

In general, prices had settled to their present level at the end of 1922, but the cost of energy has continued to decrease.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.



Changes in retail prices—December, 1913, to June, 1928

Record Industrial Operations in the Middle Atlantic States

REPORTS received on electrical energy consumption indicate that the manufacturing plants of the Middle Atlantic States witnessed a record rate of operations during September, and only slightly lower operations during October. The October rate of activity was about 1 per cent under September, but was 20.5 per cent over October last year. The average rate of operations for the first ten months of the current year was 11.8 per cent over that for the same period last year, a very normal increase for this great industrial section.

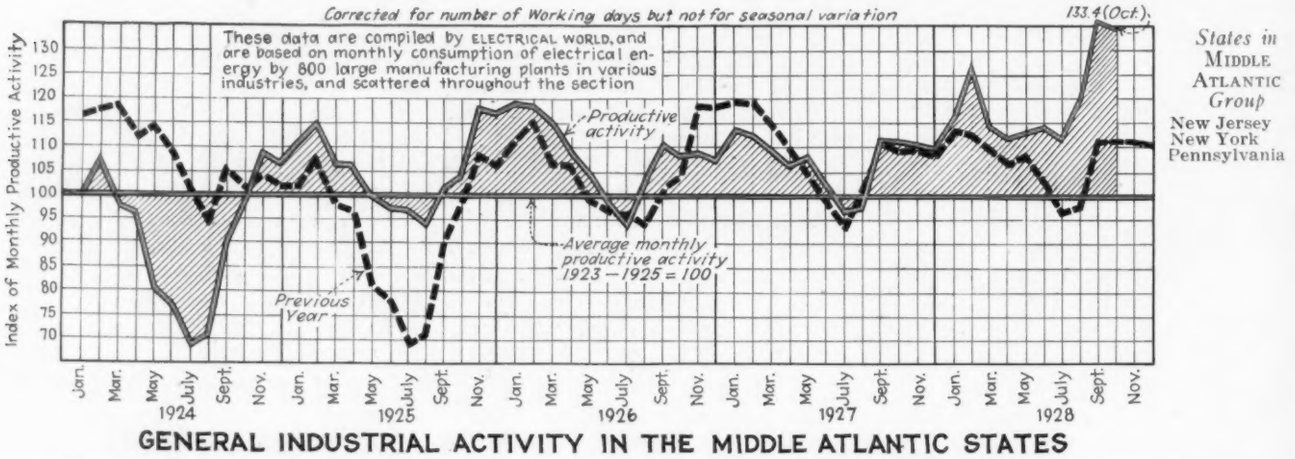
During October only two of the primary industrial groups reported a rate of operations under those of last year—the ferrous and non-ferrous metal working plants and the paper and pulp industry. Operations in the rolling mills and steel plants of the section reached record proportions in October, operating at a rate 4.5 per cent over September. The average monthly rate of operations in these plants during the first ten months of the year was 13 per cent over the same period last year. An even slightly higher rate of gain for the ten-month period was recorded by the rolling mills and steel plants in the nation as a whole.

The textiles industry, another one of the leading industrial groups of the section, was operating during October at a rate about 4 per cent under September but 11 per cent over October last year. The ten-month average operations in these plants in the current year was about 7.7 per cent over same period last year.

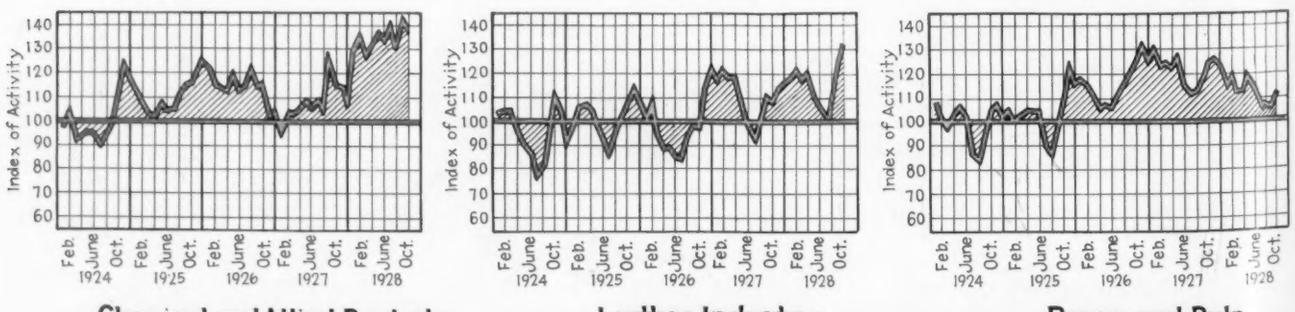
Indexes of Productive Activity in the Middle Atlantic States
All Figures Adjusted for Number of Working Days

	October, 1928	September, 1928	October, 1927	Aver. First Ten Months 1928	Aver. First Ten Months 1927
All industries	134.5	136.0	111.5	119.5	106.9
Chemicals and allied products	137.2	143.4	115.5	134.5	107.9
Food and kindred products	146.0	130.4	93.5	105.6	.....
Leather and its products	132.5	124.2	107.7	115.8	109.4
Lumber and its products	125.0	136.5	121.2	115.1	.....
Metals group	132.8	136.2	113.8	114.9	108.5
Rolling mills and steel plants	154.8	148.0	103.4	119.9	106.0
Metal fabricating plants	123.0	123.2	124.4	113.0	.....
Paper and pulp	111.4	104.9	126.5	111.9	122.1
Stone, clay and glass	140.2	149.8	112.5	128.7	.....
Textiles	120.8	125.8	108.5	114.2	106.0
Automobile	160.8	180.2	133.7	169.3	100.4

ELECTRICAL WORLD *Barometer of Industrial Activity in the Middle Atlantic States*


Corrected for number of Working days but not for seasonal variation
133.4 (Oct.)
These data are compiled by ELECTRICAL WORLD, and are based on monthly consumption of electrical energy by 800 large manufacturing plants in various industries, and scattered throughout the section
Productive activity
Average monthly productive activity 1923—1925 = 100
Previous Year
Index of Monthly Productive Activity
States in MIDDLE ATLANTIC Group
New Jersey
New York
Pennsylvania
1924
1925
1926
1927
1928

GENERAL INDUSTRIAL ACTIVITY IN THE MIDDLE ATLANTIC STATES



PRODUCTIVE ACTIVITY IN PRIMARY INDUSTRIES OF MIDDLE ATLANTIC STATES